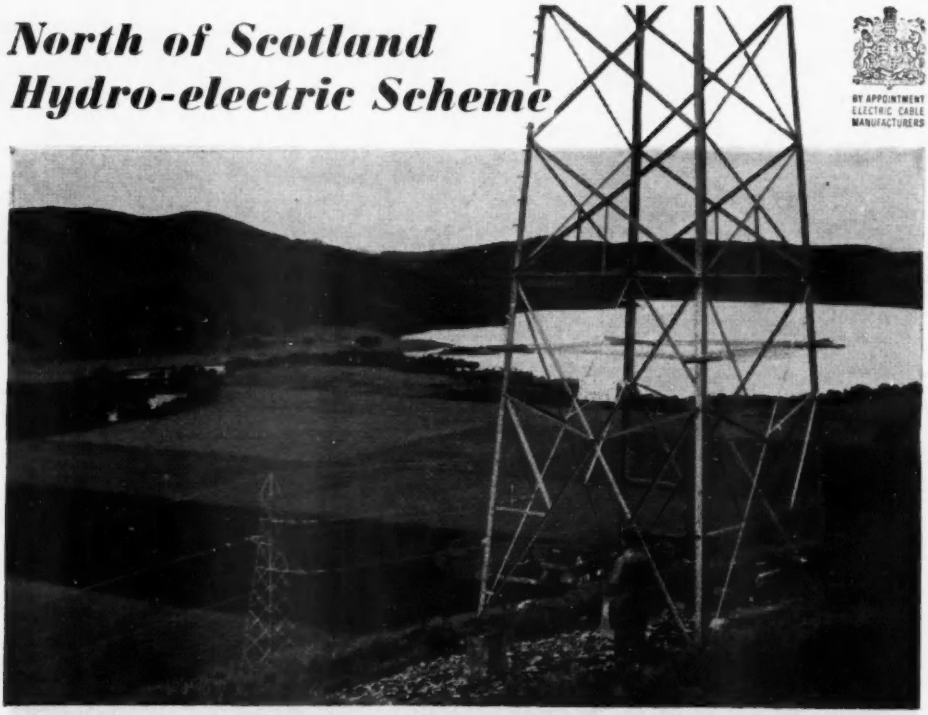
ELECTRICAL TIMES

THURSDAY
17 MAY
1951
SIXPENCE

North of Scotland Hydro-electric Scheme

BY APPOINTMENT
ELECTRIC CABLE
MANUFACTURERS



The supply and erection of some ninety miles of 132kV overhead transmission lines, over the wild and rugged Highlands, was recently entrusted to Henley's Contract Department, by the North of Scotland Hydro-Electric Board. For some sixteen miles between Grudie Bridge and Beauly, the system is split into twin single circuit lines, running parallel at a distance of 150 ft. apart, to minimise effect of lightning storms prevalent in this area. Illustration shows HENLEY towers in this section of the line, near Loch Garve.

Consultants:
Messrs. Kennedy and Donkin

HENLEY CABLES

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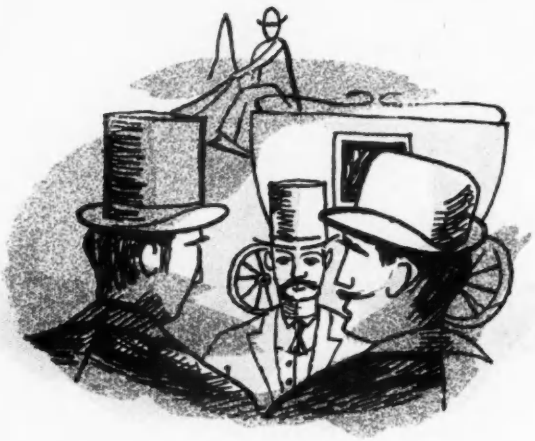

1901

In August 1901, just six months after the Victorian era had ended, a newly founded company with very small premises at Stansted in Essex manufactured the first bonded mica sheets ever made in this country. Its name was 'The Mica Insulator Co. Ltd.'

1951

Very soon it had outgrown its Stansted works and another at Walthamstow. As the variety of its products increased it changed its name to include them and became 'The Micanite and Insulators Company Ltd.,' and finally established itself on the site of the present main works at Walthamstow. It also commenced the manufacture of Empire varnished insulating materials, Paxolin laminates, Panilax laminates and Panilax moulded resin, and High Voltage Bushings and Insulators. Today M & I have several other factories and their products are world renowned.

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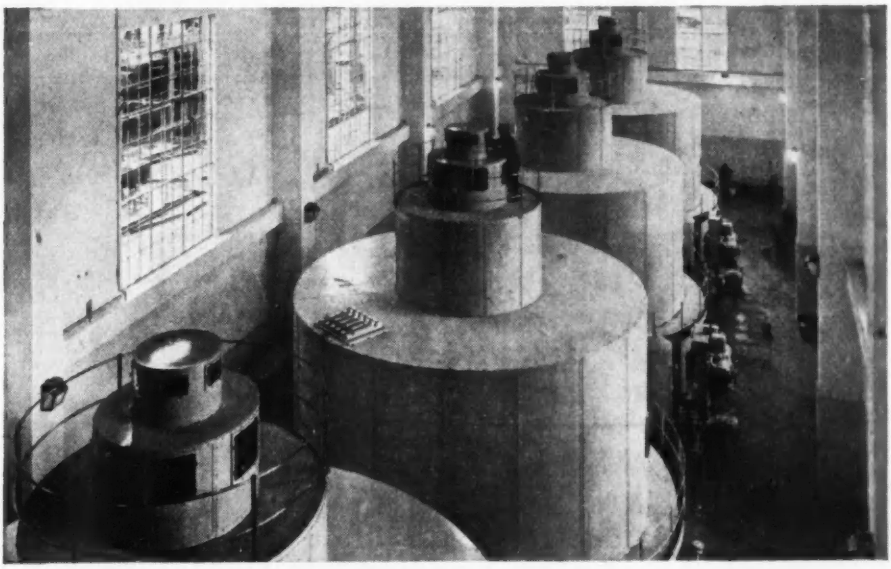
'ENGLISH ELECTRIC'

hydro-electric power



Power for half a city

The 130-Megawatt output from Loch Sloy will meet half the peak demand of a city as large as Glasgow. It will further the Scottish Hydro-Electric Board's work of electrifying annually the homes of 70,000 more people, and it will make the greatest individual contribution to the two thousand million unit increase from Scottish water power planned for the next five years.

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The Loch Sloy scheme is one of many water power projects in Scotland. For many of those as yet uncompleted, 'English Electric' are building more turbines, more alternators, to bring more power to Scotland's people.

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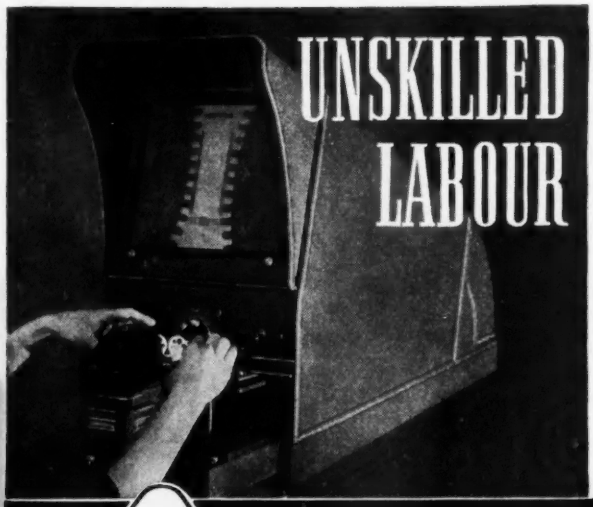

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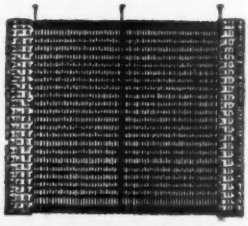

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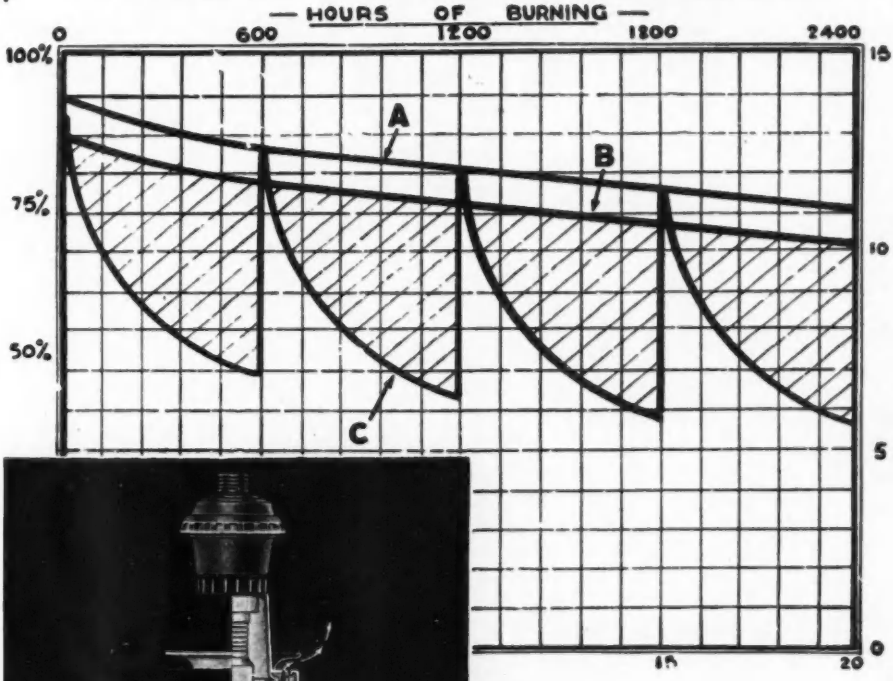

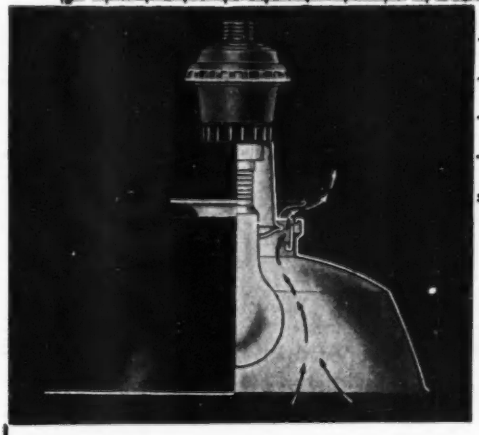

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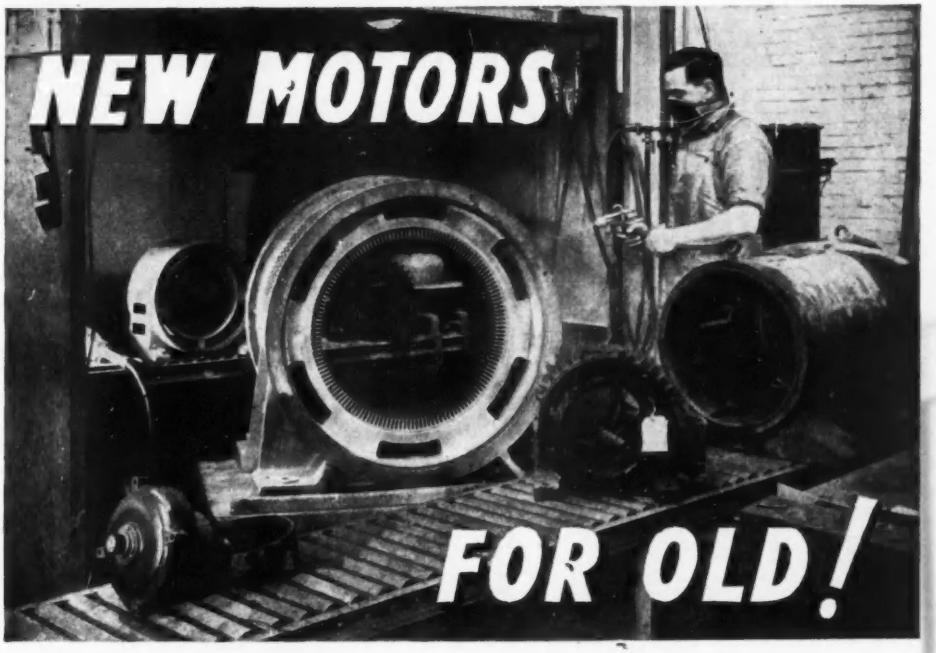

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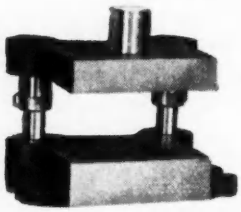
Ah ! my friends, what a moral for us all. Now at this very moment, in some toolshop or other, a skilled tool-maker is spending his time making a Press Tool Set when he ought to be making the tool. The tool will be late, delivery will be late, the customer will be lost, the firm will go broke, the Managing Director will blow his brains out—but just a moment; *if he had brains surely he would get his Press Tool Sets from*



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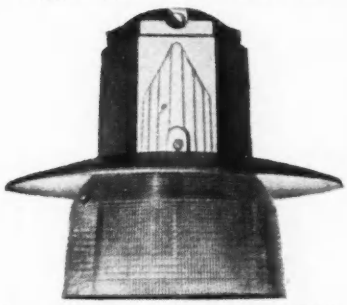
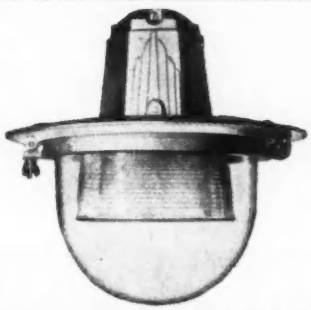


Crompton 'Star' 1 Lantern for 60/200W filament lamps, 80/125W mercury discharge lamps and 80W fluorescent mercury lamps on Group 'B' roads.



Crompton 'Argus' 1 Lantern for Group 'B' roads has an outer bowl to seal the interior against dust and weather, for 60/200W filament lamps, 80/125W mercury discharge lamps or 80W fluorescent mercury lamps.

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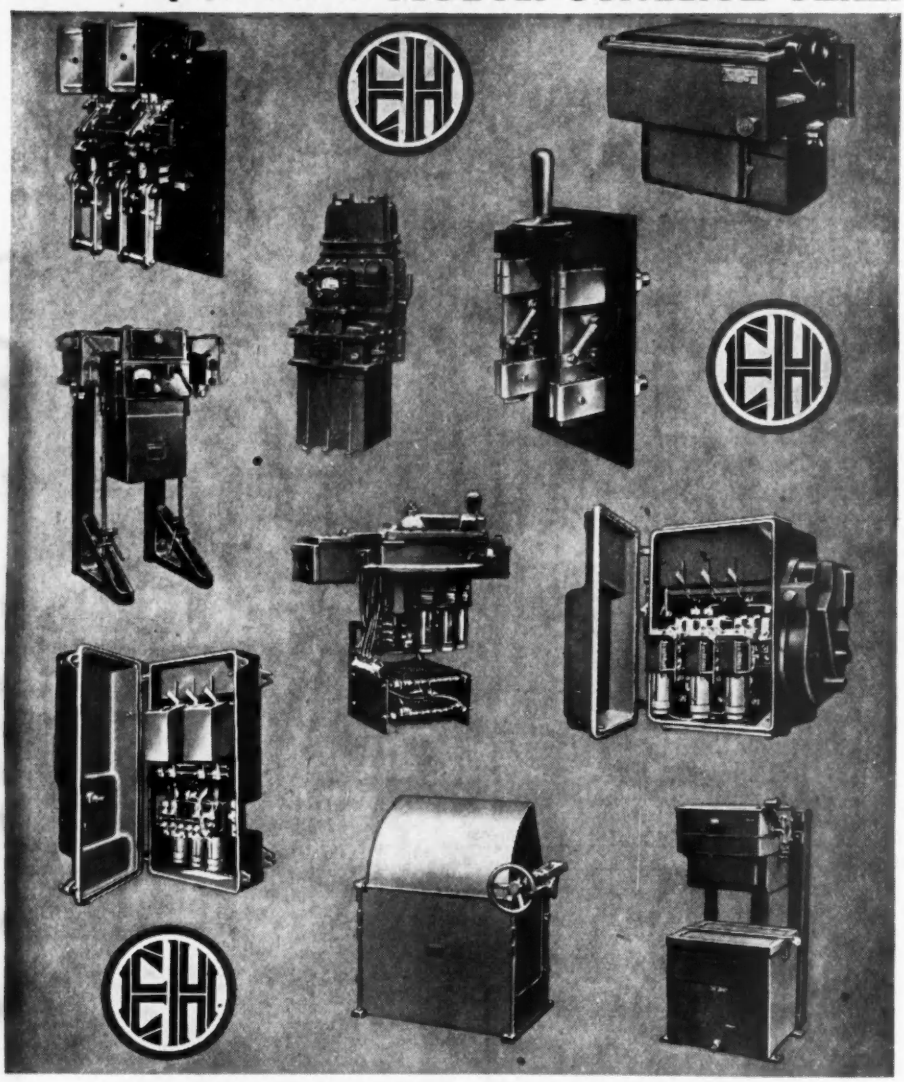

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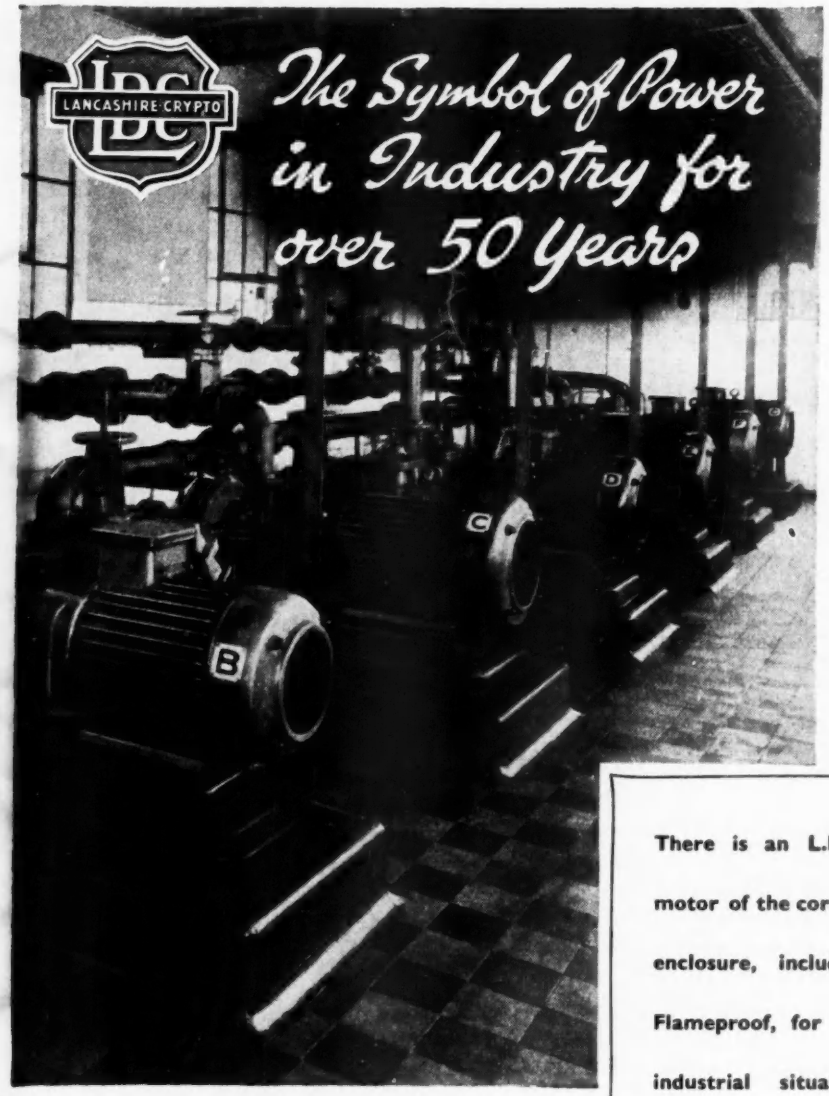

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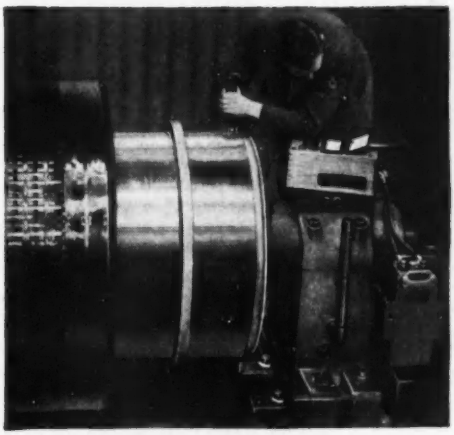
The many uses of the Ducter Ohmmeter are described in Publication J237.



A DUCTER OHMMETER ON THE JOB — in this case testing the winding of a 1000 kilowatt D.C. armature sent to the Manchester works of British Electrical Repairs Ltd., for fitting a new commutator. Ducter tests revealed faults in back and winding connections (presumably untouched since manufacture), partly explaining why the owners had experienced trouble and unequal wear on the commutator bars.

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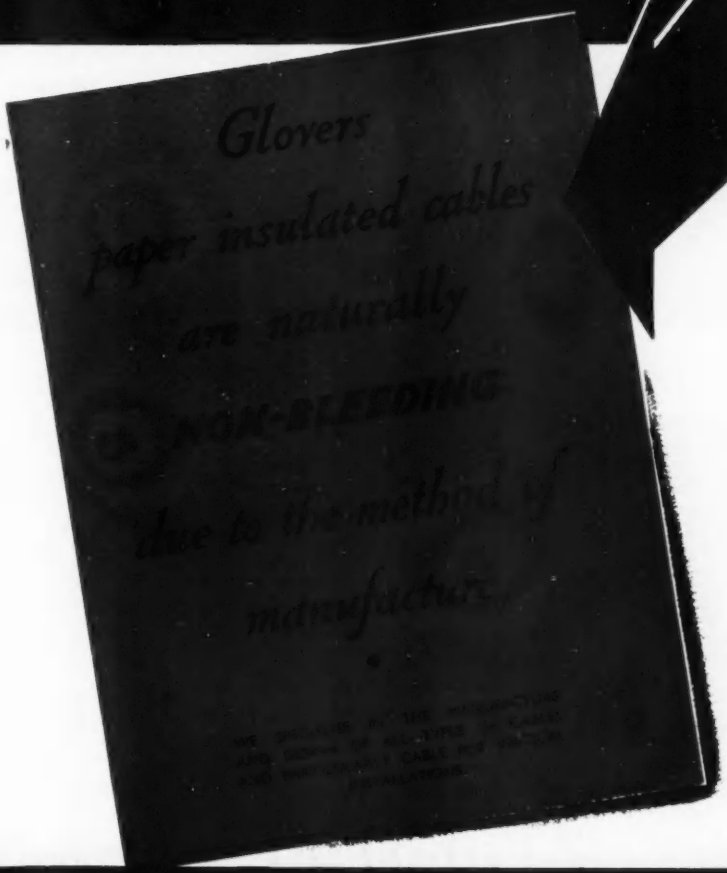

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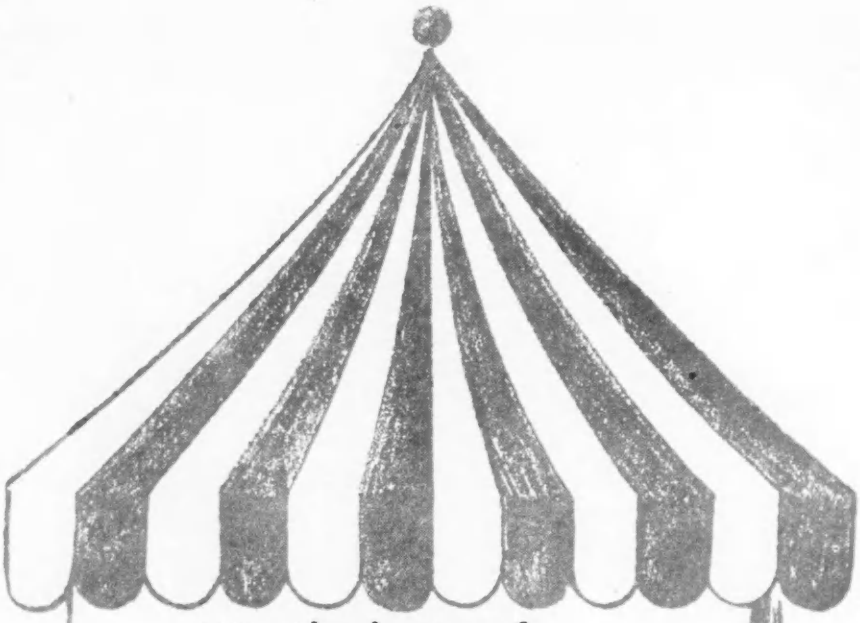

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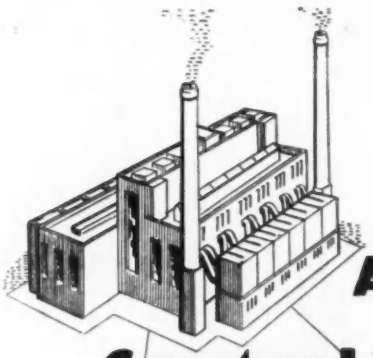

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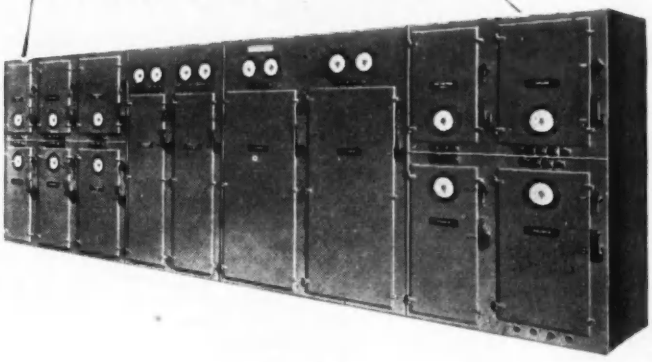

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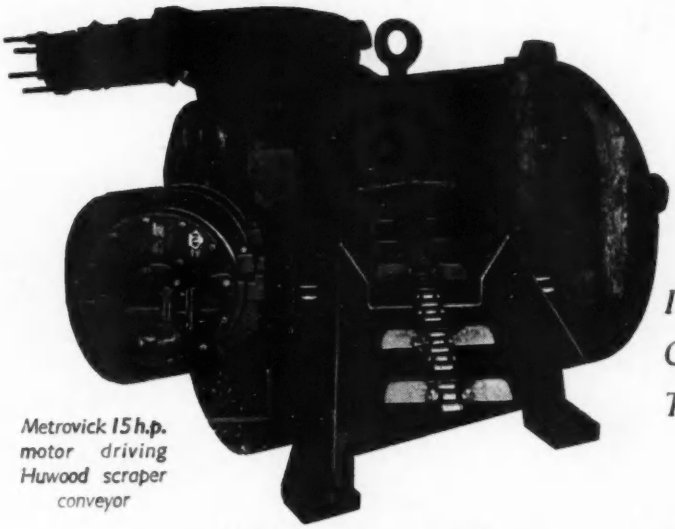
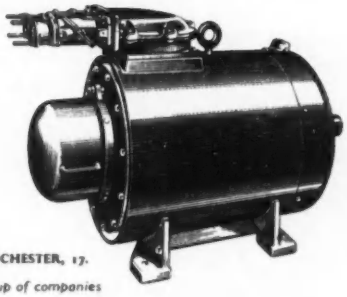


Metrovick 15 h.p. motor driving Huwood scraper conveyor

IN THE COAL WORLD THEY SAY . . .

"That's good, it's an M-V Motor"

Compliance with electrical specification and safety regulations can be taken for granted in an M-V motor. Metrovick design and build motors for every electrical use in coal mines from cutting to cleaning. The advantages of M-V machines go beyond specifications and regulations. Their reliability is built-in and it is as comforting to the user as to the designer to have the advice and service of M-V engineers who really understand the electrical problems of other industries.



A "Metrovick" 30 hp totally-enclosed fan-cooled Flameproof Motor for use underground in mines.

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METROVICK *Motors for all Industrial Drives*

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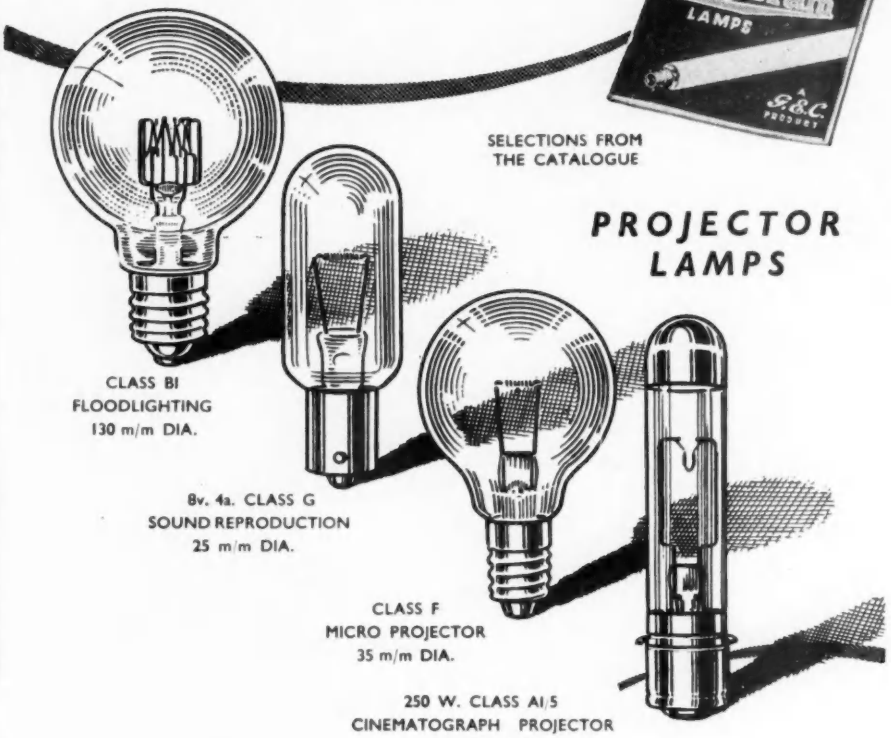

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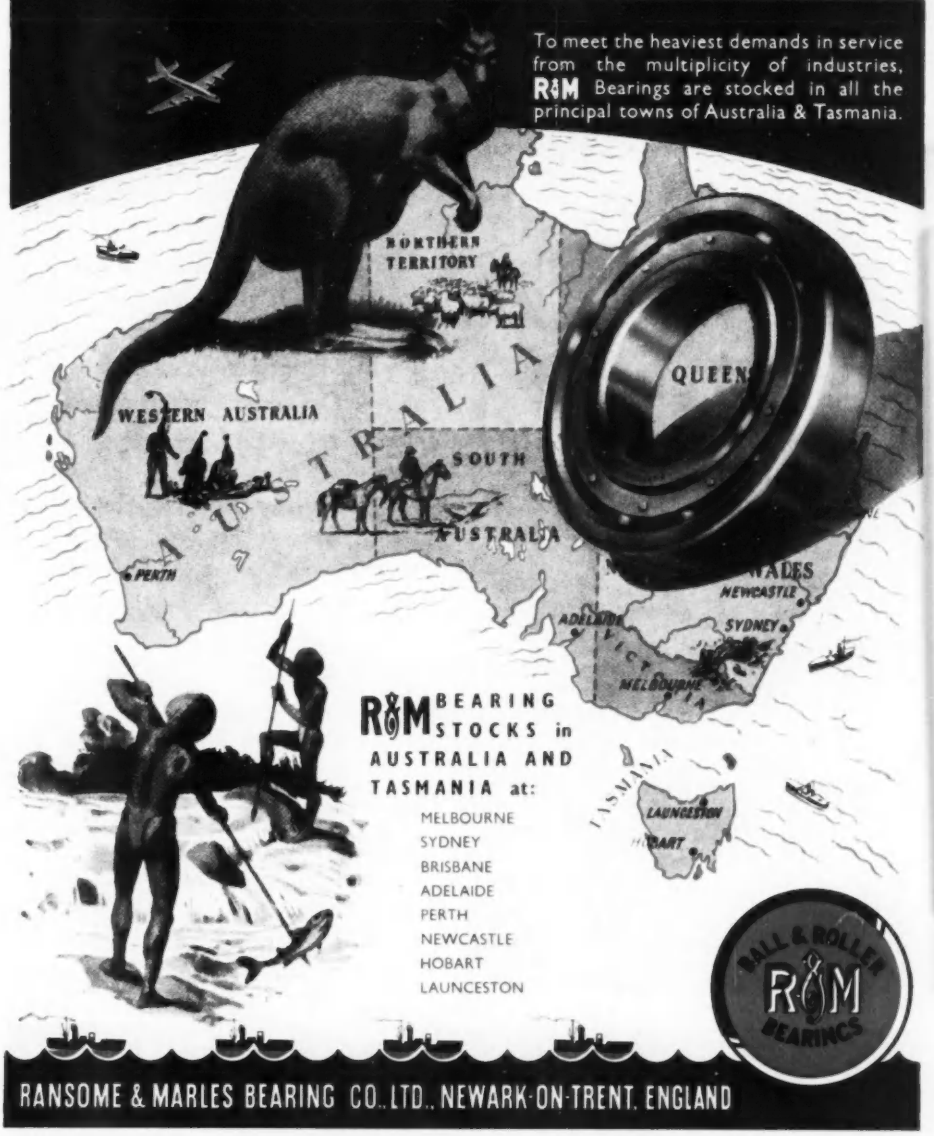

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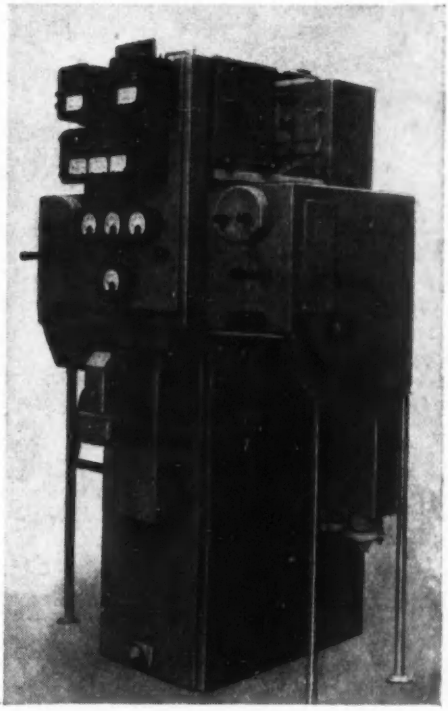

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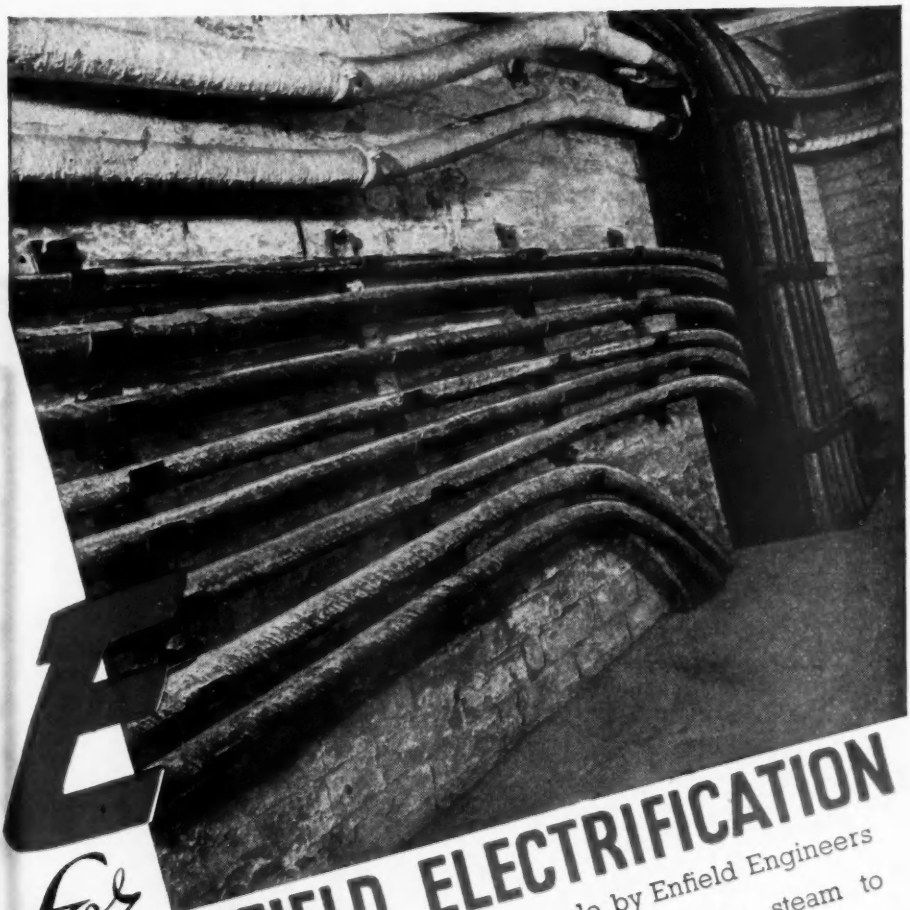

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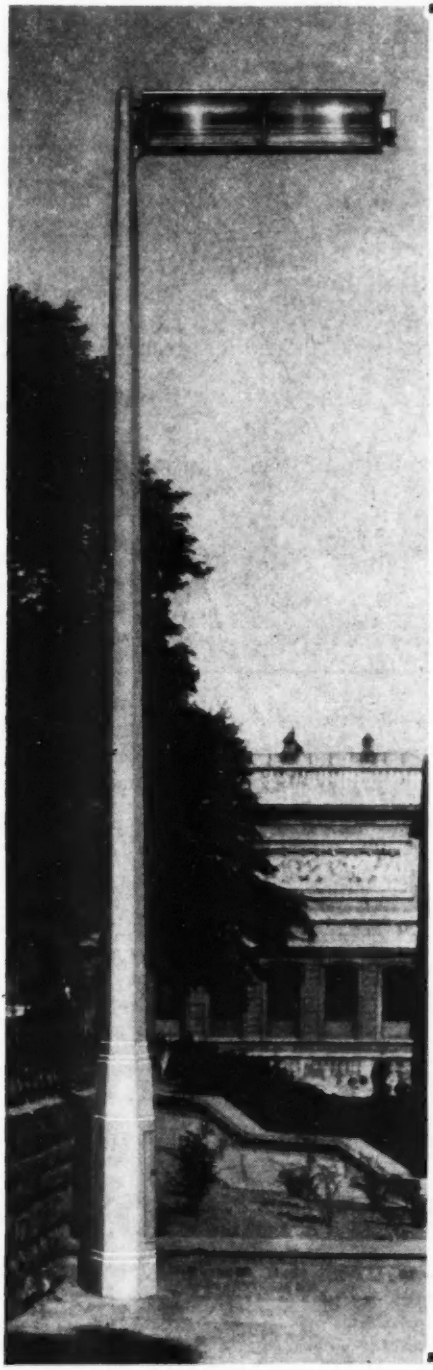

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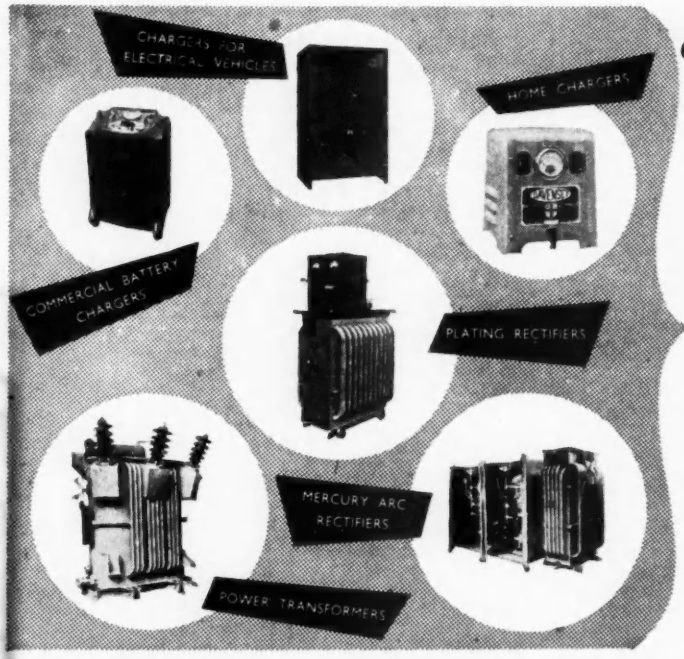

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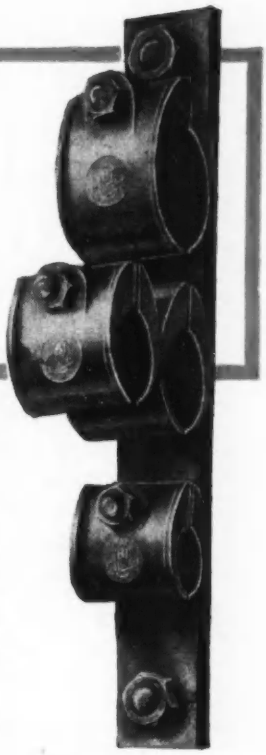
Simplify cable erection with BICC CLAW-TYPE CLEATS



BICC Claw-Type Cleats are a new invention, devised by our engineers, to make cable installation rapid and easy.

Light and strong, they consist of interchangeable units made from a corrosion-resisting alloy.

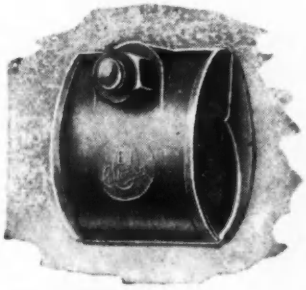
They minimise the need for special steelwork;

Are compact and space saving;

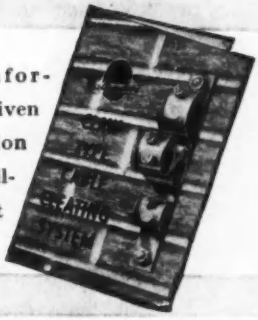
Solve cleating problems in difficult situations;

Provide for extensions and adaptations with minimum disturbance of existing cables;

And allow maximum accessibility to cables on multi-cable runs.



Further information is given in Publication No. 287N, available on request



B.I. Callender's CLAW-TYPE CABLE CLEATS

(Patent applied for)

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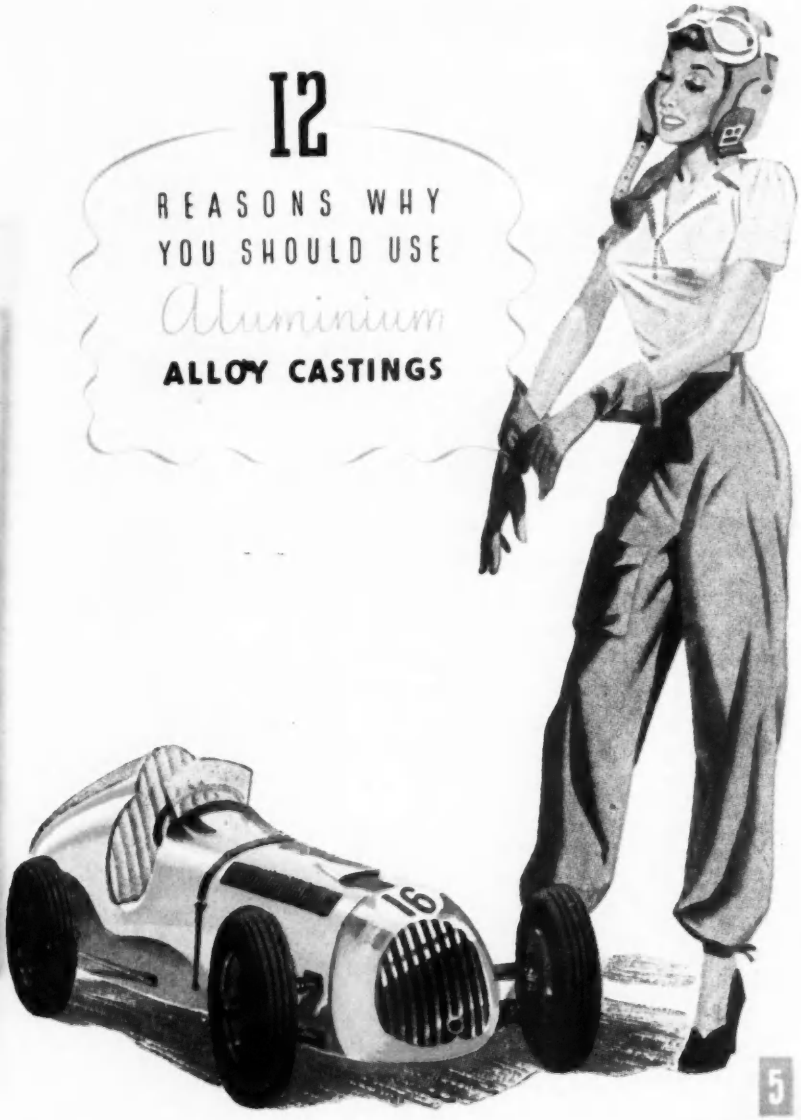

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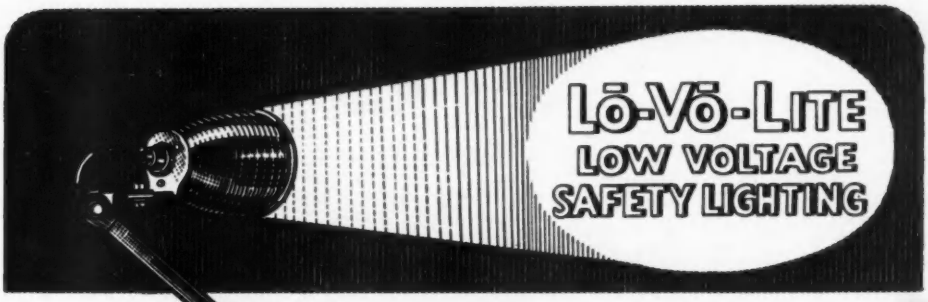

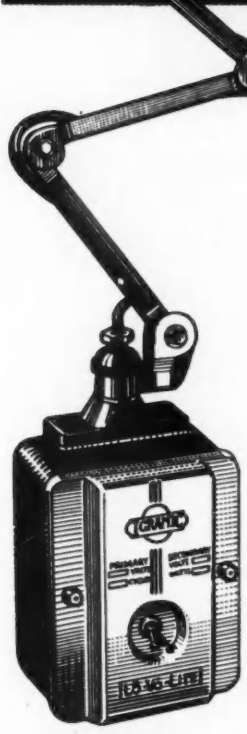

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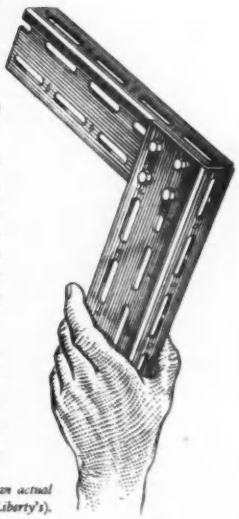

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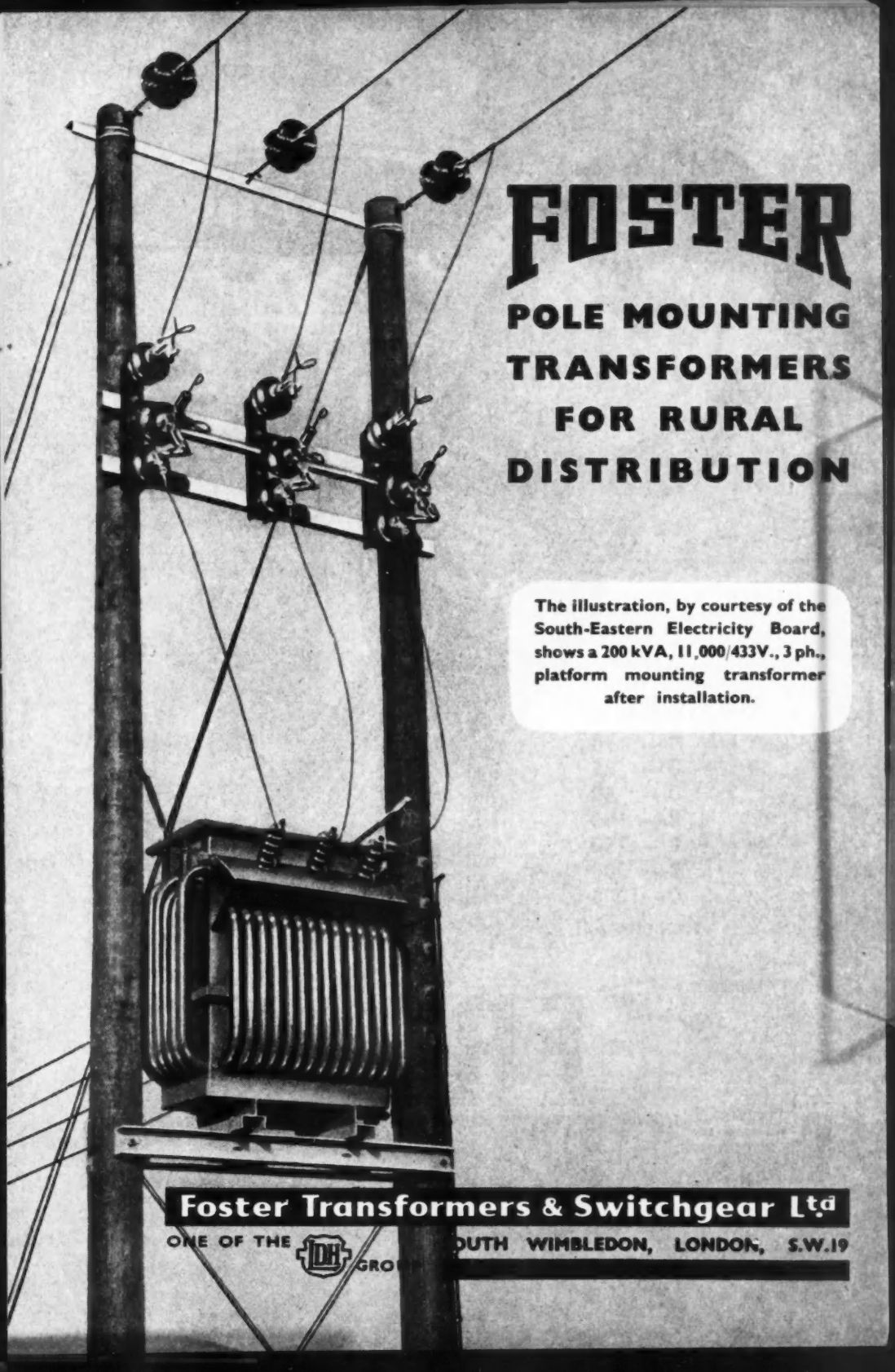

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POLE MOUNTING TRANSFORMERS FOR RURAL DISTRIBUTION

The illustration, by courtesy of the South-Eastern Electricity Board, shows a 200 kVA, 11,000/433V., 3 ph., platform mounting transformer after installation.

Foster Transformers & Switchgear Ltd

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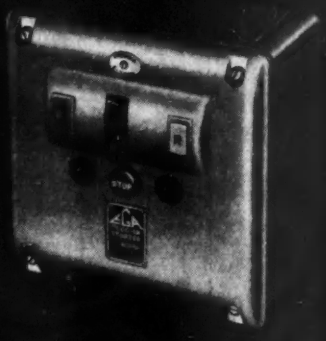
Illustration: Plug-in Reversing Starter.



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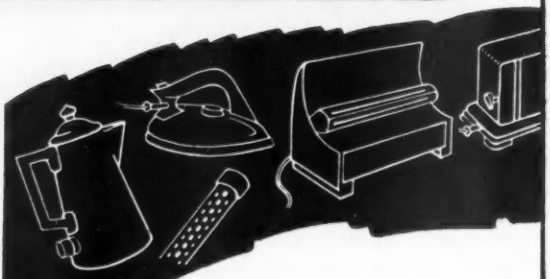

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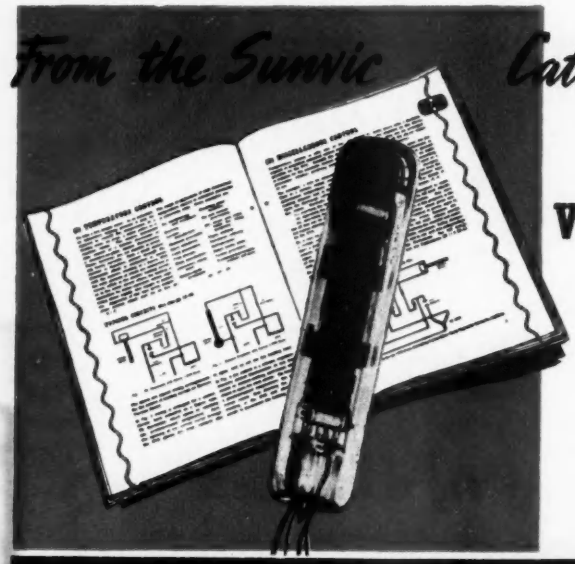

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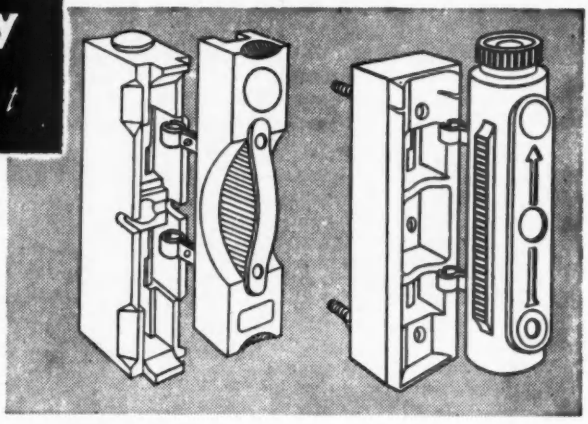

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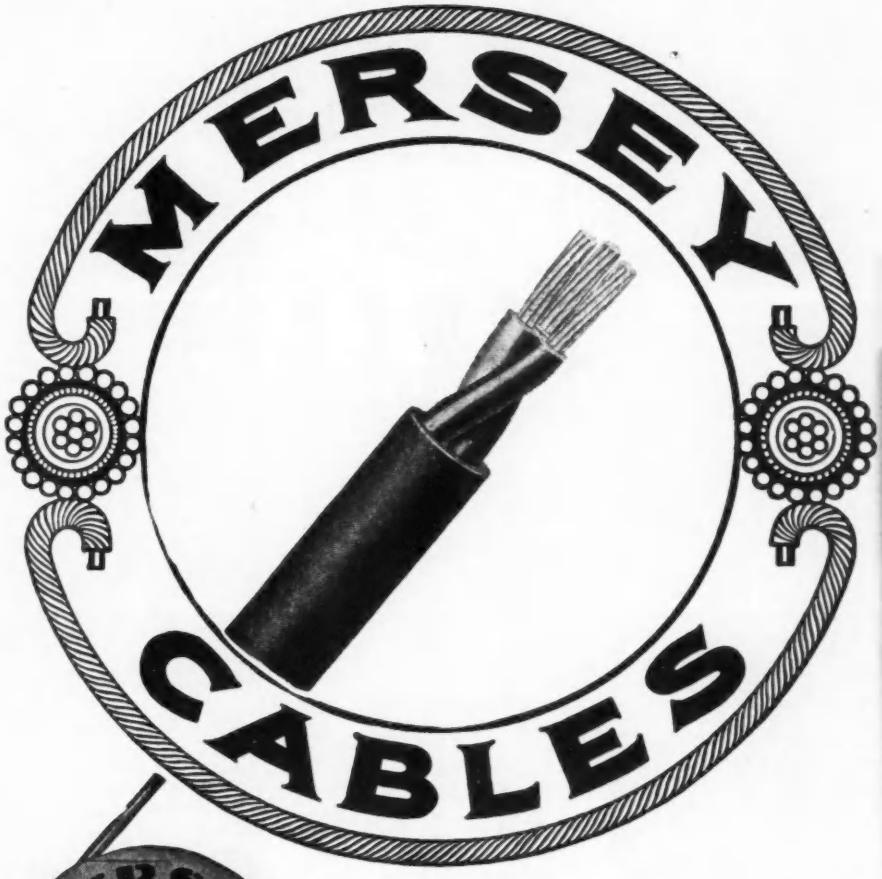

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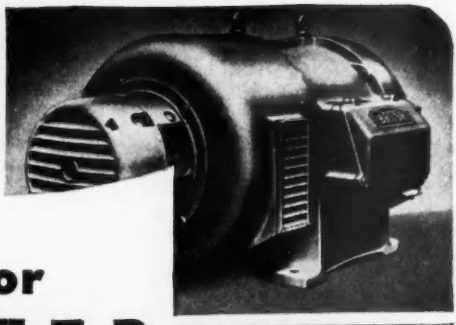

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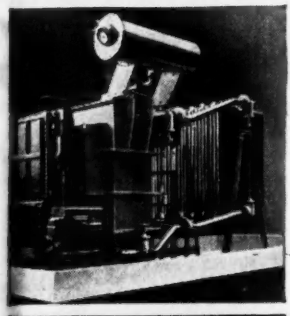

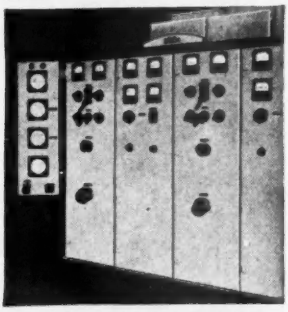

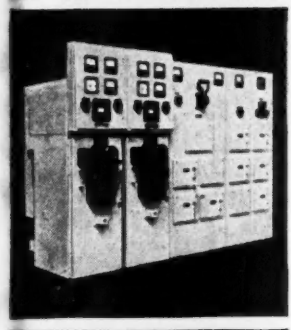

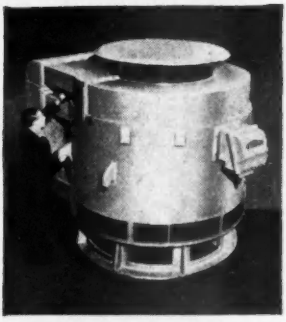

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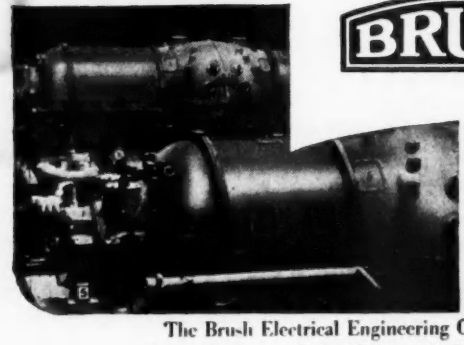

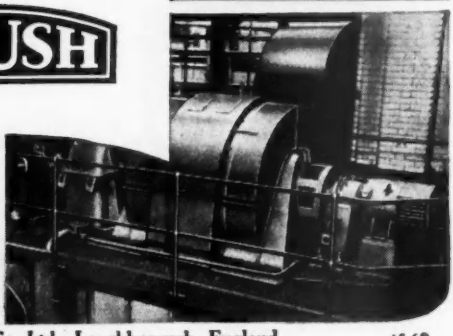

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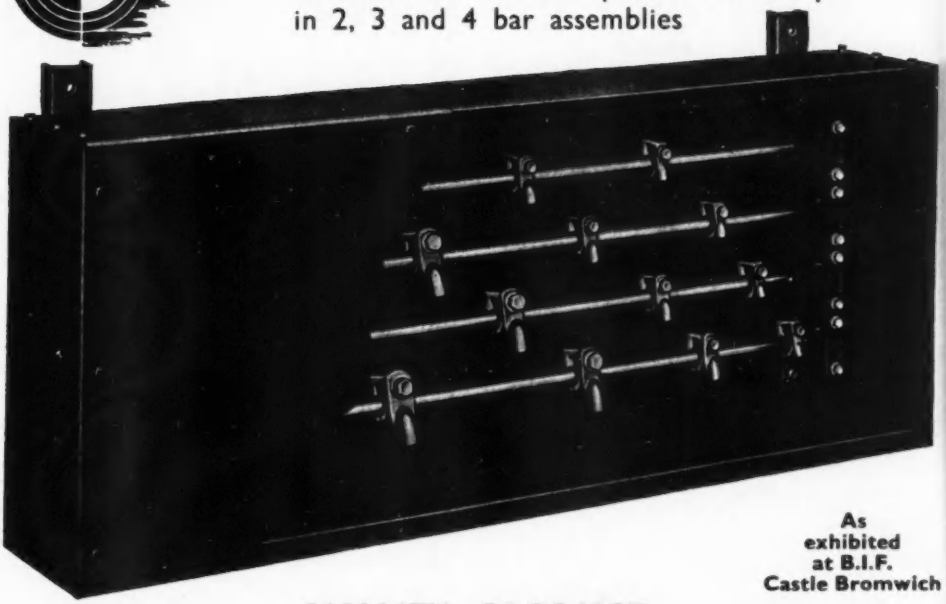

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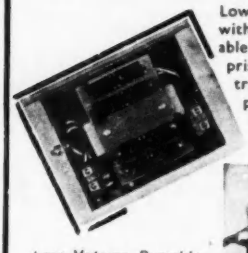

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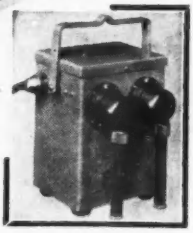

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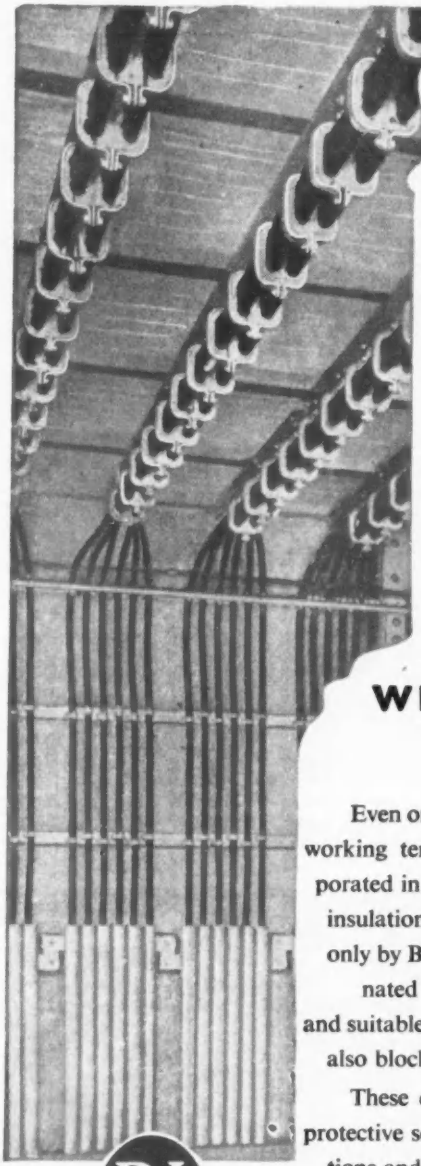

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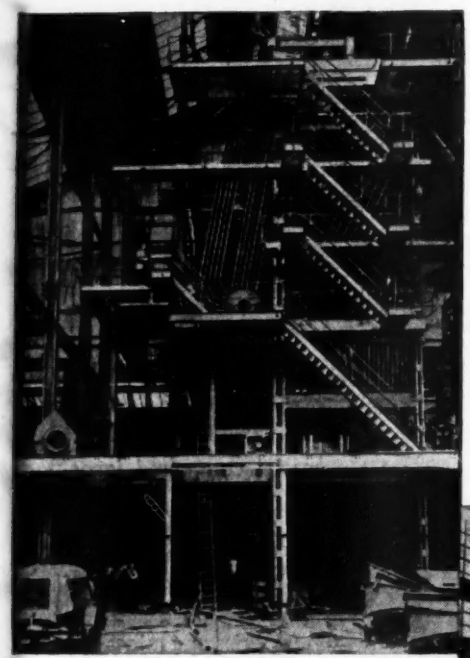

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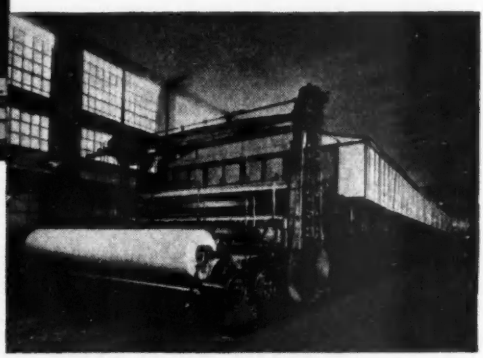

(Above). The *tenth* STIRLING boiler at Aylesford Paper Mills, during erection. This Tri-drum, high duty, water-tube steam raising unit, now nearing completion, is stoker fired and has a maximum continuous rating of 120,000 lb./hr. at a working pressure of 625 p.s.i. and a final steam temperature of 825° F.

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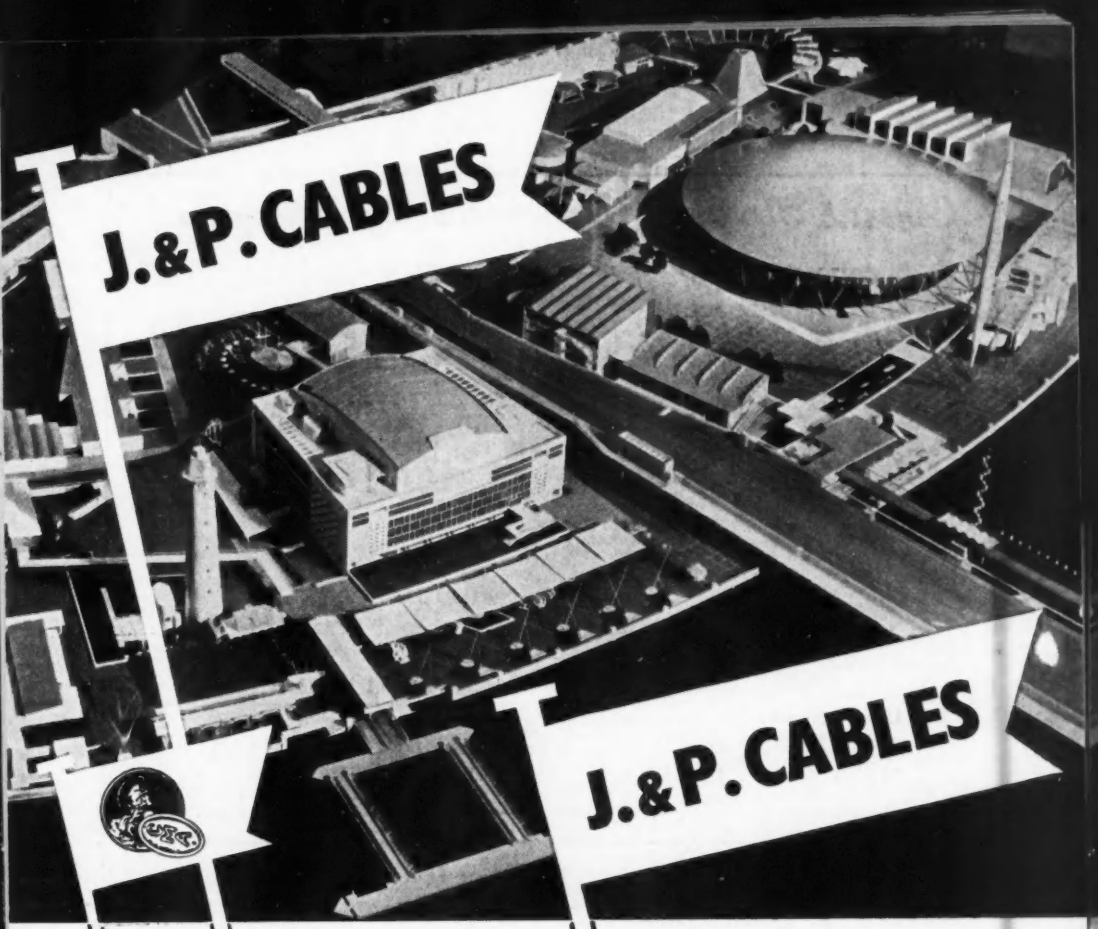

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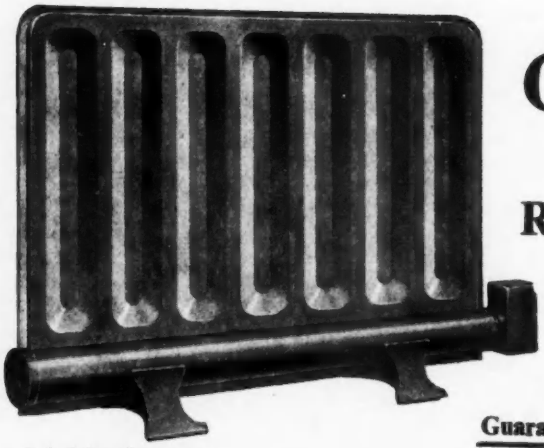

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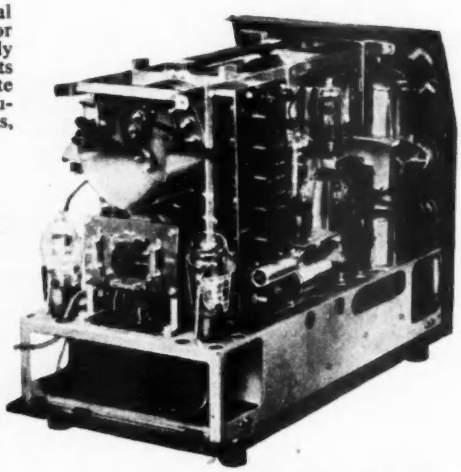

The photograph shows the chassis of a Cossor Double Beam Oscillograph

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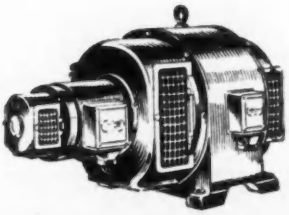

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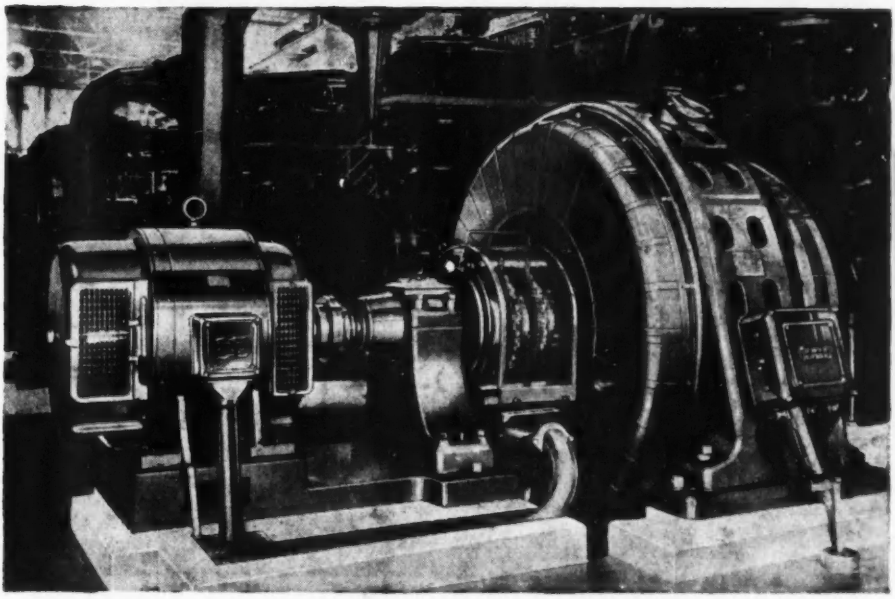

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ELECTRICAL TIMES

Vol. 119 No. 3106 THURSDAY 17 MAY, 1951

PUBLISHED EVERY THURSDAY

SIXTIETH YEAR OF PUBLICATION

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Editorial

PLANT RELIABILITY

LAST week's House of Commons statement by Mr. Noel-Baker on the subject of power cuts seems to indicate that the overall reliability of power station plant has fallen sharply during the past few months. His estimate that 28% of B.E.A. generating capacity was out of action during the recent cold spell means that the alarming total of 3,600 MW was idle when most required. About half of this—14% of the nominal total—is accounted for by the requirements of routine overhaul, and this seems a very reasonable figure for May, an improvement on recent years that results from tighter scheduling of necessary work. It is the remaining 14% that gives rise to deep concern. Three reasons are given by the Minister for the breakdowns which are the main cause of the non-availability of this capacity, and of these the outstanding case is "teething trouble" in new plant. Can, however, "teething trouble" be applied to faults occurring more than two years after plant has been commissioned ? The question is relevant since plant installed since April, 1949, totals in all only some 1,900 MW, and it is hardly likely that the greater proportion of it is out of action. The major source of trouble must be looked for elsewhere. There is a possibility that the high breakdown rate may be due to some fundamental defect, for in a B.E.P.C. paper last year, Mr. Peattie, Deputy Chief Engineer of the B.E.A., emphasised that in the overall picture, breakdown totals change only slowly: and in January, 1950, this value was down to 6% of total capacity, with an additional 2.9% lost from other causes. The Minister's statement certainly raises many queries, and it is hoped that an authoritative statement on this important subject will shortly be forthcoming.

FESTIVAL CONFERENCE

IF the scene of the Festival of Britain is the living organism of the nation, it is equally true that its offspring, the Joint Engineering Conference in June, will present British engineering in its workaday clothes. In arranging the programme, the three senior engineering institutions have wisely placed stress on the inspection of engineering works and centres of engineering interest. On most afternoons during the fortnight's conference a choice of ten or more visits will be offered and there can be hardly a single branch of engineering which our visitors from the Commonwealth, the Continent and the U.S. cannot study at first hand. This together with simultaneous sessions, at which papers will be presented by this country's engineers, will provide a unique occasion for the display of the achievements of British science and engineering to our overseas visitors. The closing date for application has been extended to May 21, so as to enable the widest support to be given to this important occasion.

FLUORESCENT REGULATION

BACK-TO-BACK thyratrons or ignitrons with phase-shifting firing as current-regulating devices have been used for years on spot welding machines and many other processes. Application to fluorescent lighting control is, however, believed to be a new development and, as will be seen elsewhere in this issue, it is certainly interesting from a technical standpoint. Its main advantage over plain resistance control is a saving in power consumption and the bulk and heat dissipation of resistors; its main handicap is its complication and consequent high capital cost. From the point of view of performance, it may have a slightly greater range, although plain resistance control, with separately heated cathodes, a scheme already in use in this country, will give a current range of at least 400-1. There is, moreover, no difficulty about re-striking with resistance control with separate resistances to each lamp, since prior to striking, before current flows, the

lamp will have the full mains voltage across it, no matter what proportion of the rheostat is in circuit. With a group of lamps, there is, of course, the tendency for the first lamp firing to rob the others. It seems that the deciding factor will be one of pure economics—savings in space occupied and power consumption being balanced against higher capital and maintenance charges. Since all these factors will vary widely with individual installations, it is not possible to forecast what reception this scheme will have in this country.

METRIC MEASUREMENT

ELECTRICAL engineers are vitally concerned in the recommendation of the Committee on Weights and Measures Legislation, in consultation with the Commonwealth and U.S.A., to establish the decimal system as standard throughout Great Britain. Probably no other profession has to deal so habitually in mixed units, for electrical units are fundamentally metric in origin while those associated with the mechanical side are usually specified in Imperial Measure. The duplication of tables and data is therefore considerable, and nearly every electrical draughtsman and designer has spent many hours converting from one system to the other. In fact, when regarded from a purely logical viewpoint, it is surprising that an industry so far in the forefront of progress, should have put up with duality of units so long. However, it cannot be gainsaid that the present state of affairs is unsatisfactory, and should the Government decide to implement the recommendation, it can confidently be accepted that the electrical industry will be one of the first to change over to a consistent system.

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BUT although the engineer, the pharmacist, the physicist and the chemist will be able to accept the introduction of a new system without particular confusion, the effect of the recommendation on the public will no doubt be to cause considerable alarm and bewilderment. As the Committee points out, decimal weights and measures need decimal coinage for the system to be beneficial to the general public, and coinage lies outside their terms of reference. Although twenty years are suggested for the changeover, the period when metric measurement reaches the retail field will provide the maximum confusion. It would seem only logical that currency should be dealt with first. While it may be possible in the first instance to limit the metric system to purely engineering design, it must inevitably extend to everyday use. The effect of two different currencies and two different systems of weights and measures in general use is too ghastly to contemplate.

BRIGHTNESS AT DULWICH

SIR GERALD KELLY certainly threw down a challenge to the Illuminating Engineering Society at their annual dinner in his references to the lighting of pictures. Never a simple matter, his particular problem, the Dulwich Galleries, is further complicated by the necessity for leaving untouched the roof lantern. This, designed by Sir John Soane and modified at a later date, is now restored to its pristine state, and is apparently the only possible position for any source of light, since it is highly unlikely that the Gallery authorities would countenance different directions of lighting by day and night. Outrageous as the suggestion may seem to patrons of the fine arts, it appears to Meteor that the matter has something in common with control room lighting, in that the basic essentials are absolute freedom from glare and irritating reflections. The technique of control room lighting has made vast strides in the last few years and a notable example of excellent results obtained in difficult circumstances was illustrated in this journal some few weeks ago. While it may savour of Philistinism to make such a comparison, it will be recalled that the ceiling arrangements of this room were apparently almost sacrosanct as well—yet the job was carried out. Although Sir Gerald's problem may be one of the "impossible" tasks which take a little longer and cost a little more, we feel confident that British illuminating engineers will find the answer somehow.

Meteor

D-I-M-M-I-N-G FLUORESCENT LAMPS

*By T. W. MACIEJOWSKI, A.M.I.E.E.**

THE technique of the dimming of incandescent lamps is well established. Several methods exist to reduce the intensity of the illumination, of which the simplest will obviously be the use of a series resistance, by means of which the supply voltage delivered to the lamps can be regulated. This method, however, is not economical as much energy is lost in the resistance, resulting in high power consumption. Other disadvantages are the bulk of the control gear and the large amount of heat to be dissipated.

A more economical method consists in making use of a variable ratio transformer for the purpose of dimming. By varying the secondary taps of the transformer the intensity of illumination can be varied practically without losses, and many existing stage lighting installations are operated upon this principle.

Another system, experimentally used for stage lighting in the U.S.A., consists in controlling the light intensity by means of small transductors (also known as saturable core reactors). By varying the saturation of the cores with the aid of potentiometers, the voltage delivered to the lamps can be regulated without extensive losses. It must be realised, however, that 100% regulation of light is not economically possible with this method, due to the very steep rise in the size and cost of the transductor when the control ratio is raised.

Since the day when the advantages of fluorescent lighting were recognised, there has been a demand for a method permitting the regulation of the light output of such tubes. Until quite recently no method was considered entirely satisfactory, since the reduction of voltage prevents re-ignition of the tubes. The use of thyratron regulators provides a complete solution.

The Thyratron Regulator

When two thyratrons (Fig. 1) are connected "back-to-back" (that is anode 1 to cathode 2, and anode 2 to cathode 1) the output current will be alternating, and by means of the grid control its value can be regulated, the full regulation of current being attained by varying the phase of firing of the thyratron from some 60 to 135 electrical degrees, or, in other words, having full light intensity at 60° and no light at 135° phase shift. Throughout the whole range the instantaneous supply voltage across the lamps remains sufficiently high to make the re-ignition of the lamps easy at any level of illumination.[1]

A further favourable condition of this method of operation is the presence of a steep voltage transient at the moment of firing of the thyratron.

Circuit Diagram

The basic diagram as given in Fig. 1 is presented in the elaborate version in Fig. 2.

To control the a.c. current two 6-amp thyratrons are used; the grids are supplied with a constant negative voltage with respect to the cathodes on which a peaked voltage is superimposed. The peak voltages are supplied by the peak transformer T3, the peak firing pulses are phase-shifted in respect to the mains voltage (Fig. 4) by means of a variable resistor R10; it should be noted that R10 is mounted in the remote control box, which permits the operation from a distant point.[2]

The phase shifting bridge proper consists of C1, C2, C3, R10 and R11. The R11 is of a semi-variable type and permits the pre-adjustment of the control circuit for the desired regulating range.

The constant negative bias voltages needed for each of the thyratrons are derived from two small rectifiers, each employing a rectifying valve type and delivering about 160 V. The correct value of the bias voltage (Eg in Fig. 4) can be adjusted by means of R5 and R6 respectively (Fig. 2).

* Philips Gloeilampen-Fabrieken, Eindhoven, Holland.

[1] It can be easily found that at the angle of 60° the instantaneous voltage vector, assuming the RMS value of the supply voltage to be 230 V: $V_{60} = 230\sqrt{2}\sin 60° = 282$ V; and similarly at the angle of 135°: $V_{135} = 230\sqrt{2}\sin 135° = 230$ V. These are the lowest instantaneous values of the supply voltage.

[2] The circuit is so arranged that the maximum light output is obtained when the minimum value of R10 is connected, and vice versa the minimum output by the maximum value of R10.

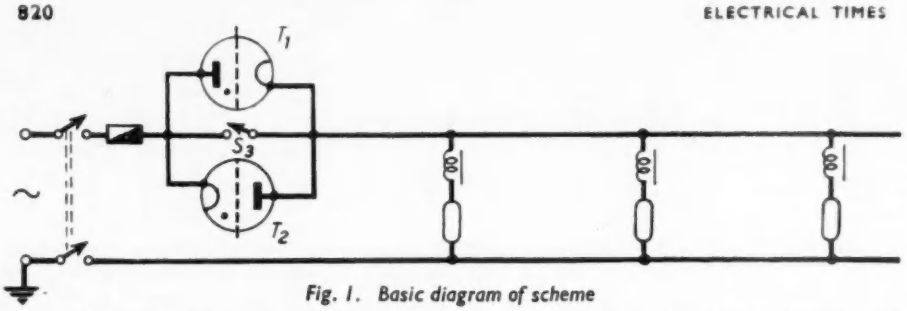


Fig. 1. Basic diagram of scheme

The terminals T1-T2 interconnect the regulator proper with the remote control box (see Fig. 3). The terminals T3 and T4 are led out to filament transformers of individual fluorescent lamps. To the terminal T5 the input sides of the ballast chokes of individual lamps will be connected.

The manual switches S1 and S2 are part of the rotary switch; this switch should be placed on the front panel of the cabinet and arranged in such a way that by turning into the first position S1 will be closed (S2 remaining open), which means that the whole thyratron regulator will be switched in as well as the filament circuit of fluorescent lamps (connected to the terminals T3-T4); this position of the rotary switch is marked "Pre-heating."

The change-over to the next position should not take place before the thyratrons are thoroughly warmed up, which time delay, in the case where 6-amp thyratrons are used, amounts to some five minutes.

After five minutes the rotary switch may be changed to the second position marked "Regulation," by so doing the S2 will be closed, while S1 will continue to remain closed. By closing S2 the fluorescent lamps will be lit, the level of illumination being dependent on the position to which R10 is set. By changing the position of the potentiometer R10

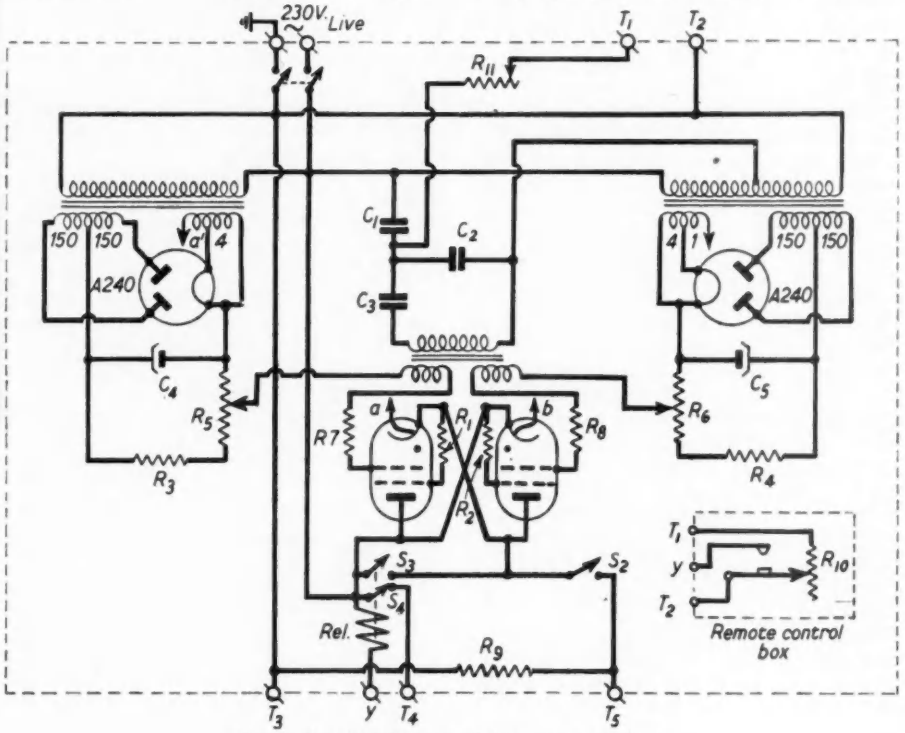


Fig. 2. Detailed diagram of thyratron control unit

the light intensity can be varied in the range of 1 : 100. By reduction of the amount of resistance R10 in circuit, the light output increases; when practically the full intensity of lighting is attained (R10=0) the switch S3 (see Fig. 2) has to be closed; during the time this switch remains closed the thyratrons are rendered non-conductive, which means that, despite the fact that their filaments remain burning, the length of life will not be affected; in other words, the thyratrons will live for as much longer.

The switch S3 can be operated by a small relay connected to the mains when, by reduction of R to zero, the contact S5 will be closed. Once this switch is closed the thyratrons become non-conductive and the lamps are fully in.

The Load Circuit

The load circuit consists of fluorescent lamps of the standard type, but whose circuit has had to be slightly modified (see Fig. 3). The most essential feature of this modification is the introduction of the filament transformer. This transformer takes over the function of the starter, known from the standard installations.[3]

The point which needs stressing is that each fluorescent lamp must be fed from a separate filament transformer, as otherwise the intercoupling between the individual lamps, connected in parallel, would prevent their proper operation and could easily lead to their destruction. Each of the secondary windings of the filament transformers delivers 6 V/0·34 A; the primary winding is connected to a.c. supply. This supply may be regulated or not regulated.

The introduction of the regulated filament voltage supply is desirable, due to the fact that

[3] It is generally known that most detrimental to the life of the fluorescent lamp are the changes in the temperature of both the electrodes; thus the function of the starter is to delay the formation of the discharge between the directly heated electrodes E1 and E2 (see Fig. 3) for the period of their pre-heating.

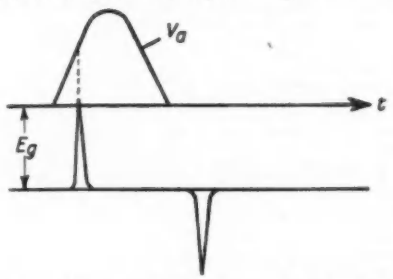


Fig. 4. Phase relation, mains and peak voltages

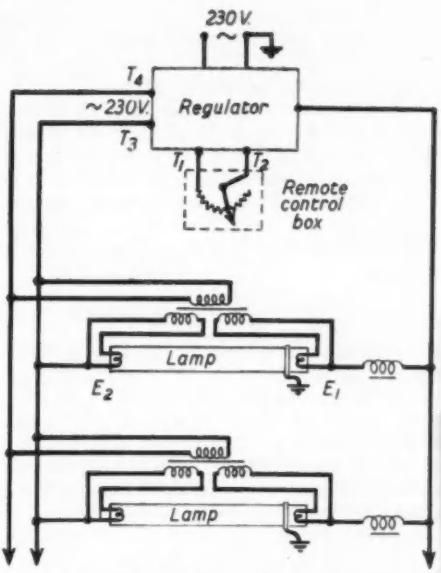


Fig. 3. Load circuit showing filament transformer

the temperature of the electrodes varies as with the current passing through the tube. Because of economical factors, however, the savings gained by a rigorous control of the temperature of the electrodes, i.e. possible longer life, must be counter-balanced against the extra cost of the regulated supply. It is believed that the regulated filament voltage supply is justified only in cases where the aim is to maintain the low-level illumination for comparatively long periods of time; for instance, in hospital wards where the dimmed light burns throughout the night. In other cases, where the reduced level of illumination will be maintained during a comparatively short period of time, the supply need not be regulated. The only precaution to be taken is to switch off this supply when the full lights are on, i.e. when the electrodes are kept warm by the high current intensity passing through the tube; the practical solution of this problem can be seen in Fig. 2 where S3 will open at the same moment as S3 will close.

The filament transformer is of small dimension and can therefore be easily housed in the fitting, close to the choke. The power factor correction capacitor should be left out; the p.f. correction, if required, has to be done centrally by means of a condenser across the mains. In order to facilitate the striking of fluorescent lamps a thin metal band of about $\frac{1}{4}$ in. width should be fixed around the glass of each tube; this band must be connected to the

fitting or else separately earthed. It is advisable to use the fluorescent lamps with the longitudinal conducting strip painted along the glass tube, and to ensure a good contact between the above-mentioned metal band and this strip. The metal band must be placed around the non-earthed end of the tube, that is on the choke side of the lamp (Fig. 3).

In order to calculate how many fluorescent lamps can be connected to a thyratron regulator of a certain size, use the following formulae:

$$n = \frac{2{\cdot}6\ I_O}{I_{TL}} \qquad \text{in which}$$

n . . . number of lamps; I_O . . . average value of current per thyratron; I_{TL} . . . current consumed by one fluorescent lamp.

Example

How many fluorescent 40W lamps can be controlled by means of the thyratron regulator using two 6,4-A thyratrons?

Answer:

$$n = 2{\cdot}6 \times 6{\cdot}4 \div 0{\cdot}42 = 40$$

The above-mentioned is valid for the single-phase supply. For the three-phase supply six thyratrons will be used, and three times more lamps will then be connected to the regulator.

Conclusion

Fluorescent lamps with dimming control may be used in theatres, cinemas, concert halls, lecture rooms or auditories, where the lecture may be illustrated by the projection of slides or films in demonstration rooms, operation rooms, hospital wards, etc. The technique reviewed in this article was developed in the Philips laboratories in Holland.

The possible higher cost of installation is easily repaid by the very considerable saving in consumed energy and increased life of the fluorescent tube.

This technique has also been successfully applied to high voltage gas discharge tubes with the filament heating transformer omitted. In the case of neon lighting, as used for the lighting of cinemas, the thyratron control permits the dimming of long and short tubing at an equal rate.

Art and the I.E.S. Dinner

AMUSING references to his dual personality were made by SIR GERALD KELLY in proposing the toast of "The Illuminating Engineering Society" at their annual dinner on Wednesday of last week when he referred to his two offices of President of the Royal Academy and Honorary Surveyor of the Dulwich Galleries, in stressing the importance of suitable lighting for the display of works of art. In the process of cleaning the Dulwich pictures, they had been lucky, and he wanted the whole world to see his pictures. Mentioning the difficulty of improving on Sir John Soane's design, he pointed out that he had visited galleries in many European countries without finding a successful solution of the problem of artificial lighting—obviously the I.E.S. had not been consulted! The Honorary Surveyor had told him that the President of the Royal Academy would be in a strong position to point out that unless the illuminating engineers found a solution he could see no reason to propose their health. As President, he had replied to himself that such a course was undignified, and he had much pleasure in proposing the toast, hoping that under the stimulus they would solve the problem.

Replying, MR. L. J. DAVIES (President, I.E.S.) referred to the fact that the Society was now 40 years of age—and its membership showed a comfortable middle-age spread. Thanking Sir Gerald for his interesting and stimulating speech, he remarked that they had one thing in common, what the scientist would call positive poles in the matrix of knowledge. He knew nothing about pictures and, to judge from Sir Gerald's experiments with the room lighting earlier in the evening, Sir Gerald knew very little about illumination!

Humility, he went on, was a fine thing, but he felt that the Society, as craftsmen of light, was too humble. Did we ever remember that the I.E.E. could be said to be started by illumination—since Faraday's first entry in his journal referred to light? The eye knew nothing of the complications of illumination—it had the extremely simple job of transmitting a message to the brain, and the task of the illuminating engineer was to ensure that the message was acceptable. Co-operation between illuminating engineers and all users of light would ensure that this task was fulfilled.

Proposing the toast of "Our Guests," DR. W. J. WELLWOOD FERGUSSON said that although the President of the Royal Academy, a professor of physics and a professor of electrical engineering amongst the principal guests might seem an odd assortment, it was in reality extremely appropriate since the illuminating engineer must be a bit of electrical engineer, a bit of physicist, and a great deal of artist. Replying, PROFESSOR WILLIS JACKSON said that the electrical industry resembled a swan. On the surface it sailed along smoothly and placidly—but it worked damned hard underneath!

Troubles—and Remedies

A series of trouble-shooting tables specially compiled to assist maintenance engineers in rapid fault diagnosis

No. 6. A.C. GENERATORS **By S. SPENCE, B.Sc.**

A.C. generators, being the primary source of energy from which most electrical plant obtains its supply, are naturally in more continuous service than electric motors and are therefore available at less frequent intervals for thorough examinations at rest. Early detection of developing troubles from working examinations is therefore essential to avoid serious breakdowns which might put a very considerable amount of electrical plant out of service. In the case of large turbo-generators, the parts visible during normal operation are limited and the log readings of the various recording instruments consequently play an important part in providing a means of indicating to the maintenance engineer any variations of the operating conditions from normal whereby early warning of developing trouble is ensured.

SYMPTOM	CAUSE	REMEDY
General overheating.	Overloading.	Reduce the applied load either by reducing mechanical load of motors supplied from the generator or by disconnecting the requisite number of feeders.
	Restricted ventilation due to obstructions such as dust deposits in the generator ventilating ducts or in the screens of a forced ventilation system.	Dismantle the machine or the ventilating screens for cleaning as necessary.
	Heavy out-of-balance loading of a polyphase generator.	Re-distribute the load to obtain reasonable uniformity of the stator phase currents.
Overheating of the rotating field winding.	Overloading.	Reduce the applied load as in the case of general overheating.
	Excessive excitation due to low power factor.	Reduce the wattless load by improving the power factor of the load. The most common methods are (i) the installation of capacitors and (ii) the incorporation of one or more synchronous motors in the load. The latter may serve the dual purpose of supplying mechanical power and improving the power factor of the system.
	Excessive excitation due to speed being too low, possibly as a result of trouble in the prime mover.	Locate and rectify the trouble responsible for the reduced speed.
Overheating of the rotating field winding accompanied by vibration. (Check the log of the excitation ammeter readings as an abnormal increase will give immediate indication of a short-circuit in the field system.)	Short-circuited turns in the rotating field. In this case, although the rotor current increases, the effective ampere turns of the winding may have decreased, thereby resulting in a lagging power factor being *increased*. Trouble has been experienced with long cylindrical rotors of large generators due to axial deformation of the end-windings as a result of "copper shortening," i.e. permanent contraction of the conductor in the slot portion. Frequent starting and stopping, with consequent repeated heating and expansion of the conductors which are mechanically clamped to prevent movement, appears to bring about this phenomenon.	Confirm the existence of a fault by varying the field on no-load when a reduction of the field flux will be accompanied by a noticeable reduction in the vibration (the vibration, of course, being the result of a magnetic out of balance). Check the rotor resistance for any appreciable variation from normal. In this connection a true reading at standstill does not necessarily dispose of the possibility of a short-circuit which might exist only at speed. (See Note 1.) To reduce the risk of axial deformation of field windings care should be exercised to prevent overheating of the rotor and to avoid overloading of the generator. Frequent starting and stopping should also be avoided as far as practicable.

SYMPTOM	CAUSE	REMEDY
Sparking at the slip rings and overheating of brushes and rings.	Unequal current distribution between the brushes due to:—	
	(*a*) Unequal brush pressure.	(*a*) Equalise and if necessary increase the brush pressure.
	(*b*) Unsuitable brushes or varied types of brushes on the same ring.	(*b*) Consult the makers to ascertain the most suitable type of brush which should be fitted throughout. As an emergency measure, treatment of the ring with an abrasive will improve the brush surface and probably equalise the current distribution.
	(*c*) Formation of an air film under some of the brushes, resulting in excessive current being carried by others.	(*c*) These troubles can usually be eliminated by cutting axial slots across the face of the brushes, whereby dust and air are expelled and better cooling of the surface effected. An alternative to slotting the brushes is to slot the ring in the form of a spiral groove.
	Excessive contact voltage due to dust accumulation at the brush face.	
Overheating of the negative ring only.	The negative field ring frequently wears more rapidly than the positive ring due to transference of metal in the direction of current flow, the action being more pronounced with higher current densities and with copper and bronze rings.	The simplest remedy is to change the polarity of the rings from time to time. The trouble is not experienced to the same degree with steel rings.
Overheating of bearing.	Inadequate supply of oil to a pump-fed bearing, which may be due to the oil level in the tank being too low, thereby allowing air to be drawn in with the oil. (This would be indicated by a milky appearance of the oil.)	Overhaul the pumping system and top up the oil level in the tank as may be necessary.
	Insufficient flow of water in water coolers due to breakdown of pumps, obstruction of filters, or deposits thrown down from the water in the cooling tubes.	Check through the water system, cleaning, overhauling or repairing as may be found necessary.
	Leakage of cooling water into the oil.	Locate and rectify the source of leakage.
Overheating accompanied by pitting of the bearing surfaces.	Circulating currents flowing through shaft, bearing, housing and bedplate which may be due to unequal air gap or out of balance between three-phase windings, the resulting unbalanced flux distribution producing stray fields tending to cause magnetisation of the shaft. Short-circuits also give rise to this lack of magnetic symmetry.	To prevent bearing currents it is usual to insulate the exciter end bearing pedestal from the bedplate whilst pedestals may be of non-magnetic material. It is necessary to take care that the insulation is not bridged by a metallic conductor such as a water pipe, wiring conduit or armouring. Care should also be exercised when refitting pedestal bolts or dowels to ensure that these are adequately insulated and insulation leakage paths free from metallic dust. In the case of trouble being experienced when the pedestal is not insulated, it may be possible to fit a brush to rub on the shaft on the rotor side of the bearing and divert the shaft current from the bearing direct to the pedestal.
Hot bearing (all types).	Imperfect alignment, coupling or gear drive.	Re-align correctly.
	Driving belt too tight.	Reduce belt tension.
	Driving belt too far from bearing (due to excessive overhang of pulley).	Modify belt drive accordingly and if necessary fit an extra bearing to share belt load.
	Heat transferred from rotor or stator.	See causes of general overheating.
	Adjacent source of heat.	Modify drive to enable generator to be removed from the path of the transmitted heat. Alternatively interpose a suitable protective barrier between the generator and the source of heat.
	High ambient temperature.	Reduce by improving ventilation. Alternatively and if practicable change location of generator.
Hot bearing (ball and roller).	Incorrect fit:—	
	(*a*) Inner race too tight on shaft.	(*a*) Polish shaft and re-fit bearing, making race a tight press fit (an interference fit) to prevent "creep."
	(*b*) Outer race tight in end bracket.	(*b*) Polish end bracket housing as necessary to make bearing race a sliding fit on its seating.
	Too much grease.	Remove excess grease.
	Wrong grade of grease.	Replace by suitable grade recommended by the makers after due consideration of normal operating temperature conditions.
	Diametric clearance too small.	Fit new bearing having larger clearance.

SYMPTOM	CAUSE	REMEDY
Hot bearing (ring oiled).	Insufficient oil in well.	Top up oil level.
	Leakage of oil from well past drain plug or gauge glass.	Refit drain plug or gauge glass correctly.
	Oil well overflow pipe bent or displaced, thereby reducing oil level in well.	Refit pipe in correct position.
	Obstruction in overflow pipe.	Flush out and refill with oil.
	Oil ring stationary or sluggish in action due to:—	
	(*a*) Ring tight in slot.	(*a*) Reduce width of ring and polish sides smooth.
	(*b*) Ring damaged.	(*b*) Repair or renew ring.
	(*c*) Foreign matter in oil.	(*c*) Clean oil.
	(*d*) Wrong grade of oil.	(*d*) Replace by suitable grade.
	(*e*) Bearing turned in housing due to set Screw becoming loose or defective, thereby displacing oil ring slot from normal position.	(*e*) Re-secure bearing in correct position.
	(*f*) Oil ring jumped out of slot.	(*f*) Fit retaining strip across top of slot.
	Bearing metal dust or other obstructions in bearing oil grooves.	Remove bearing for cleaning of grooves.
	Bearing oil grooves incorrectly cut.	Remove bearing and modify grooves, making sure they are correctly located, cut and backed off. The inside of the ring slots should also be backed off.
	Tight bearing.	Scrape bearing to correct fit.
	End thrust on bearing due to:—	
	(*a*) Incorrect assembly.	(*a*) Reassemble generator with rotor in magnetic centre.
	(*b*) Faulty drive.	(*b*) Modify drive as necessary to eliminate end thrust.
	Shaft out of true.	True shaft in lathe and renew bearings.
Fluctuation of load current.	Defect in prime mover such as faulty governor, defective rotor of driving motor, or slipping belts.	Locate and rectify the external defect.
	Intermittent short-circuit in the rotating field. Intermittent open circuit in the exciter, regulator, rotating field or interconnecting leads or defective contact at slip rings.	Trace and repair defect.
	Fluctuating, unbalanced loads such as arc furnaces during starting periods.	It is undesirable for such loads to be supplied from a single generator.
Generator fails to generate.	Defect in exciter:—	
	(*a*) Open circuit in field winding, interconnecting leads or field regulator.	(*a*) Locate and repair break.
	(*b*) Excessive resistance in shunt field circuit due to defective joints, terminal connections, regulator contacts, etc.	(*b*) Trace and repair defect.
	(*c*) Short-circuits in field coils or leads, or earth faults which cut out of circuit a large portion of the field winding, or short-circuit between field and main circuit windings.	(*c*) Locate and repair defective portion of winding or leads.
	(*d*) Residual magnetism lost.	(*d*) Disconnect and separately excite the field winding only from an external source such as a battery for a few minutes. Then reconnect the exciter normally.
	(*e*) Field winding reversed.	(*e*) Reverse connections to field winding and run the machine above its rated speed. If necessary short-circuit the armature to cause the excitation to build up.
	(*f*) Individual field coil or coils reversed.	(*f*) Correct connection and confirm by checking polarity of poles.
	(*g*) Field regulator wrongly connected with resultant inadequate excitation.	(*g*) Reconnect to obtain correct regulation.
	(*h*) Open circuit or short-circuit in armature winding.	(*h*) Locate and repair fault.

SYMPTOM	CAUSE	REMEDY
Generator fails to generate (cont.).	(*i*) Excessive contact resistance at commutator due to:— (1) Dirty or tarnished commutator. (2) Insufficient brush pressure. (*j*) Wrong brush position which may be due to incorrect re-assembly after overhaul or repair.	(*i*) (1) Clean and polish commutator surface. (2) Increase brush spring tension. (*j*) Reset brushes in correct position.
	Rotating field circuit broken due to defective connection, open circuit in winding, or inadequate brush contact on slip-ring.	Locate and rectify defect.
	Field circuit wrongly connected, which may occur in reassembling after overhaul or repair.	Check and reconnect or refit coils to obtain correct pole sequence.
	Short-circuits or earth faults in field system resulting in a considerable portion of the exciting winding being cut out of circuit.	Locate and repair defective portion of winding.
	Open circuit in stator winding.	Trace position of fault by suitable tests and repair defective portion of winding.
Generator voltage too low.	Defect in exciter:— (*a*) Too much resistance in exciter circuit.	(*a*) Cut out more resistance by means of regulator or remedy any defects such as bad contacts in the regulator, faulty terminal connections, etc.
	(*b*) Reversed field coil or coils.	(*b*) Re-connect coils correctly.
	(*c*) Individual coil or coils short-circuited.	(*c*) Repair faulty coil or coils.
	(*d*) Incorrect connection of field winding such as two parallel circuits being erroneously connected in series after repair or overhaul.	(*d*) Re-connect correctly.
	(*e*) Wrong brush position.	(*e*) Reset brushes correctly.
	(*f*) Air gap too large, which may be due to incorrect assembly after repair or overhaul.	(*f*) Reassemble poles correctly.
	Speed too low.	(*g*) Increase speed to normal and remedy any defects in drive such as faulty governor which may be responsible for the trouble.
	Rotating field winding connections short-circuited or reversed. Under these conditions vibration will be in evidence.	Locate and repair defective leads or reverse connections to obtain correct pole sequence.
	Short-circuits in the actual field windings, resulting in a large portion of the winding being cut out of circuit.	Locate faulty coil by removing and checking resistance. Alternatively, a suitably reduced voltage applied to the stator winding will induce e.m.f.s in the rotor coils and heat up the faulty one. See also previous reference to tracing short-circuits which exist only when the machine is running.
	Stator winding wrongly connected, which may be due to a coil or coils having been inadvertently reversed during a repair of the winding.	Confirm by checking individual voltages of the phase windings, locate and correct the faulty coil connections.
Current surge and phase swinging.	Momentary loss of field flux followed by reversal of exciter polarity, due primarily to exciter instability and aggravated by sudden load increases on the generator.	To improve the stability of the exciter the brushes should be rocked forward as this necessitates an increase in the field current to obtain the desired voltage. Alternatively, insert a rheostat or permanent resistance in series with the main field circuit. (See Note 2.)
Reversal of exciter polarity.	Short-circuit on the system or opening the shunt field switch for a few seconds and then re-closing it, whereby the resulting induced rotor e.m.f. effects a momentary current reversal in the exciter shunt field.	A series field winding on the exciter tends to prevent reversal of polarity. But the most reliable method of preventing reversal of exciter polarity and of eliminating exciter instability generally is to dispense with self-excited exciters and use a pilot exciter for supplying the main exciter shunt field, together with an automatic voltage regulator.

SYMPTOM	CAUSE	REMEDY
Unstable generator voltage.	Excessive capacitive load, resulting in voltage rise and a tendency for the machine to become unstable and self-exciting.	This trouble is mainly confined to single machines, which should therefore, not be, connected to excessive capacitive load.
	Excessive and sudden increases in induction motor load, resulting in fall in voltage, which may be aggravated due to the field being weakened by the armature reaction effect.	A suitable voltage regulator will usually eliminate such undesirable voltage instability. But in certain cases some system of field forcing may be desirable to effect more rapid increase of the rotor excitation when necessary to counteract the effect of armature reaction before the pull-out torque is reached. (See Note 3.)
Unequal load distribution between generators operating in parallel.	Machines and exciters having dissimilar characteristics.	Alteration of excitation, of course, only affects the wattless load, and the effective output can only be regulated by altering the output of the prime mover. (See Note 4.)
Hunting of generators operating in parallel.	Electrical impulses transmitted from the supply end due to faults on other machines or prime movers.	If hunting in a generator reaches dangerous proportions (such that the generator may fall out of step) it is advisable to consult the makers of the prime mover responsible for the trouble.
	Mechanical impulses from the prime mover of the generator due to such troubles as varying steam pressures or faulty governor.	
Circulating currents between generators operating in parallel.	Such currents are set up when the star points of machines with dissimilar characteristics are connected together.	The addition of suitable reactors will usually reduce the circulating currents to a reasonable value. These circulating currents, which are of harmonic frequencies, often occur as the result of earthing more than one neutral point of generators in parallel and form the chief objection to this practice.
Unsatisfactory voltage regulation of generators operating in parallel.	Unsuitable type or incorrectly connected regulator (e.g. if the current coil leads of a compounded regulator are reversed, the excitation of the generator in question will increase and it will take more than its fair share of reactive kVA).	To ensure close control of both voltage and power factor of generators operating in parallel, it is desirable that the automatic voltage regulator should be compounded, i.e. have both voltage and current coils. In this connection it is important that the current coil should be energised from one phase while the voltage coil is supplied from the other two phases of the three-phase supply.

NOTES CONCERNING THE TABLE

Note 1. To locate an intermittent short circuit (which is present only under the influence of centrifugal force) extremely careful measurement of the resistance with direct current is necessary, starting from standstill and repeating at different speeds until a sudden change confirms the existence of a short. Similar measurements of individual pole resistances should then be made to locate the faulty pole.

Note 2. In persistently troublesome cases it may be necessary to fit stability plates to the exciter field magnets. An iron plate, having a cross-section considerably less than that of the pole, is inserted between the back of the pole and the yoke to form part of the magnetic circuit. The thickness and cross-section of the plate are adjusted to obtain the desired stability.

When shutting the generator down it should be allowed to come to rest with the exciter field switch closed. Otherwise loss of the exciter residual flux might result.

Note 3. A check of the machine stability can be carried out by measuring the excitation to produce full load stator current on short-circuit and the excitation to give normal voltage on open circuit, the sum of these two being approximately equal to the excitation required at full load zero lagging power factor load at normal voltage.

Note 4. To obtain automatic sharing of the effective load, the governors of the prime movers must have the same characteristics, and for automatic sharing of the wattless load the generators must have equal voltage regulation. When joint control of several generators is effected by mechanically coupling their field regulators, the exciters should have similar voltage curves, the same voltage regulation, and the same field regulator steps.

LUMINESCENCE

Royal Institution Lecture follows Annual General Meeting of the I.E.S.

PROFESSOR E. DA C. ANDRADE acted as host to the Illuminating Engineering Society, who held their annual general meeting on Tuesday of last week at the Royal Institution.

The President, MR. L. J. DAVIES, in presenting the annual report for the year drew attention to a revision of the Articles of Association, which now permitted five vice-presidents serving for two years instead of three serving for three years each. He also referred to the success of the summer meeting held in Buxton in May of last year, and said that plans were now being made for a further meeting to be held in Eastbourne in May, 1952.

Referring to the Register of Lighting Engineers which has now been in operation for nearly three years, the President pointed out that it totalled 212 names at the end of the year. Dealing with the accounts, he said that they showed a reasonable excess of income over expenditure, but if the present activities were to be maintained in the face of rapidly rising costs, steps must be taken to raise additional income.

Names of officers and members of Council to take office in October and the award of an Honorary Membership were then announced (see "Personalities," page 838), after which the report was adopted by general acclaim, MR. W. ROBINSON (E.D.A.) and MR. F. M. HALE (Ministry of Transport) proposing their adoption and recording members' appreciation of the efforts of their Council.

Luminescence

Professor Andrade then gave a lecture on "Luminescence." It had been stated as axiomatic in 1662 that "the cause and substance of light is fire," said Professor Andrade, but he proposed to deal with the light emitted from cold bodies, by various methods. Commencing with light emitted by glow worms and fireflies, he instanced the firefly as an example of efficient energy transformation of 576 lumens/watt. Curves of energy distribution were shown which emphasised the striking difference between the amount of visible light emitted compared with that of a tungsten lamp.

Luminescence, however, could also be produced by chemical means, and he gave demonstrations of the light produced by an oxidising action on luminol (3-Aminonapthalhydrazide) firstly by passing ozone through it producing luminous bubbles, and then by the action of a weak solution of potassium ferricyanide. Light was also emitted by crystals of fluor-spar when heated. This type of luminescence involved the use of energy—in both chemically and heat induced luminescence the property was "boiled out" as it were, and the substance rendered afterwards inert.

Turning to luminescence induced by ultra-violet light, Professor Andrade pointed out that the duration of the afterglow varied over a very considerable range, and demonstrated that it was, in fact, negligible in the case of liquids. At the other end of the scale he instanced the modern poster inks which had a long afterglow. Here he digressed to cover the problems of applying these inks. Fluorescent properties of many solids were dependent on particle size—if the particles were ground too fine no fluorescence resulted, so that these inks had to be fairly coarse-ground and it was necessary to print by the silk screen process.

Measurement of Afterglow

Methods of measuring short-time afterglow by the use of the phosphoroscope were described, this utilising a rotating disc carrying the phosphor which was excited at one point of the revolution and the afterglow examined through an aperture in a screen which could be revolved to any point in the circumference. Knowing the angular velocity of the disc, very short periods could be measured with an accuracy unobtainable by other means.

Response of phosphors to various frequencies of light were demonstrated by exciting the powders by a projected spectrum, to demonstrate Stokes Law that the radiated emission must be of lower frequency than the exciting light.

The quenching of luminescence by the red and infra-red end of the spectrum were demonstrated by the same means, and it was shown that two kinds of quenching existed, one being true quenching, the phosphor darkening visibly under infra-red. The other effect, referred to as "flash-up" quenching, gave a momentary *increase* in brightness before darkening, when infra-red was applied.

The effect of temperature on fluorescence was demonstrated by several experiments. Increase in luminescence with rise in temperature was shown by a phosphor-coated glass cylinder, irradiated with ultra-violet light and the afterglow observed while the cylinder was filled with hot water. Fluorescence at low temperatures was demonstrated with mercuric iodide and lead iodide, neither of which were fluorescent at normal temperatures but gave brilliant results when cooled with liquid air.

Professor Andrade then gave a short talk on the theory of fluorescence explaining the apparent inconsistencies of certain substances, with the aid of energy-level diagrams showing radiationless transmission from one level to another, and explained the occasional inconsistencies obtained from experimental results, such as apparent infringements of Stokes Law and the appearance of fluorescent properties at very low temperatures.

Notes on Wiring
by MEGOHM

AT THE FAIR

Some defects in detail

I VISITED the British Industries Fair at Castle Bromwich, and spent some time on manufacturers' stands. Unfortunately, there is little new to report in connection with materials and equipment used on low and medium voltage installation work.

One manufacturer, I noticed, has concentrated on a more pleasing colour and better finish for the cases housing switch and distribution equipment. He is also fitting protective shields over live metal contacts and terminals on the switch mechanism which, of course, considerably reduces the possibility of accidental contact, and at the same time the fitting of these shields increases the safe breaking capacity of the switch.

Recessed Switchboard

On another stand a section of a main cubicle switchboard, which I understand has been manufactured for one of the British Electricity Authority's new power stations, was on display. This switchboard has been constructed for recessing into a cavity with access being obtained to the mechanism and connections by removal of the front panels. The front panels are nicely finished in blue pastel colours with chromatic paint finish beading and Perspex labels being fitted to indicate the purpose of each unit; the whole assembly giving a neat and pleasing appearance.

Other equipment I saw could be improved without much effort. For example, busbar insulators held to the sheet metal case by $\frac{1}{4}$ in. dia bolts and square press nuts is not a very sound electrical engineering job. Another bad example was on a consumers' control unit, where exposed live metal could be accidentally touched with possible serious consequences. This is surely something the manufacturer can easily overcome by properly shielding live metal against accidental contact.

On competitive switch and distribution gear, why do manufacturers put in a series of knock-outs in this type of equipment? For example, in a small distribution board I saw about a dozen $\frac{3}{4}$ in. knock-outs in the end plates.

Again on switchgear, there are three knock-outs provided on the top and bottom plates which electricians tell me are more of a nuisance than a help, as very often it is necessary to re-drill these plates for a larger hole and with knock-outs this usually means making and fitting new plates.

In general, the cases of distribution and switchgear have been improved, but there is still much to be done to produce a streamlined dust-tight case, minus projecting lugs, etc.

Ducts

Various types of floor, wall and ceiling metal ducts and troughs were on view, together with metal skirting ducts fitted with compartments for various services. It occurs to me that the success of a metal skirting duct installation is one that depends mostly on the architects, as without their co-operation the field for use of metal skirting ducts, I would say, is very limited. A combined under-floor duct system and metal skirting ducts should be an ideal flexible system for outlet points to any desired position.

The usual selection of switches, switch sockets and accessories were displayed on several stands, including multiple sockets on one plate and three way adaptors for 13 amp sockets. It appears there still is a demand for plug adaptors, presumably because a sufficient number of sockets are not being installed on new installations.

One new and very useful accessory is a 15 amp flush switch with overall dimensions similar to the 5 amp flush switch. This 15 amp switch is made as a one-way single pole or double pole and also as a two-way switch, and is suitable for connection to a.c. circuits up to 240 V only. This has been wanted for a long time by installation engineers, since in the past there has always been difficulty in combining 5 and 15 amp switches in a common box.

Time did not permit a visit to other stands which I would have liked to have seen, but on my way out one last fleeting upward glance at the untidy overhead wiring and drops to the display stands, reminded me there is now available a neat and efficient flexible overhead wiring system which should be very suitable for exhibition work.

Electricians Want Another Rise

Action Advocated at E.T.U. Conference

A NEW campaign for higher pay was launched at the Electrical Trades Union Conference at Hastings, last week. The delegates voted overwhelmingly in favour of a special executive resolution in which six branch wage motions had been composited. Noting that wage increases obtained had been offset by the steep and rapid rise in the cost of living, the resolution deplored the deterioration of the living standard of the Union's members and urged the executive to take all possible steps to satisfy their legitimate claims for higher wages "at the expense of profits." Proposing the motion, Mr. W. C. Stevens, the general secretary, said that the profits of industry had increased last year. Unless effective steps were taken they could continue to increase and further to exaggerate the totally unjustifiable present position in which the workers found themselves. It was time that the Trade Union movement gave the matter the serious consideration that it deserves, he declared.

The serious threat to the living standards of the members could only be met by insistence, through all the means at their disposal, that effective steps must be taken to counteract the "tremendous stockpile of undistributed profits by private enterprise". Only three delegates opposed the resolution.

Immediate Application

Another resolution was carried which called for an immediate application to the contracting employers for a substantial increase in wages, and for strenuous efforts to obtain consolidation of the temporary hourly addition into the base rate. Resolutions were also adopted which instructed the executive to press for a fortnight's holiday with full pay for all sections of the electrical industry, and for equal holidays for manual and clerical workers.

A move to encourage a higher standard of workmanship by introducing compulsory registration of electrical operatives was opposed by the executive, and defeated. Instead the conference passed an amendment asking for legal enforcement of a higher standard of efficiency of components and materials.

Criticism in the president's address of worker-management relations in the British Electricity Authority was endorsed by the conference during Wednesday's proceedings, when a resolution calling upon the executive to press for more democratic control of the industry was adopted. Asserting that no progress had been made, the motion stated that the Authority and the Area Boards operated in a manner little different from those controlling various parts of the industry in pre-vesting days. There was a wastage of manpower, materials and money which did not occur during private enterprise, declared the proposer, Mr. F. Walmsley, of Manchester, who asserted that when a service was being installed in a house between 10 and 12 yards of cable were used compared with three yards which was considered ample before nationalisation. Today there were four managerial positions where one had sufficed, and four technical staff where only two had been required. In the Manchester area a man who, prior to vesting date read 100 meters daily now, because of red tape, had a job to read 30. People were running the Authority contrary to the principles of nationalisation because a large percentage are those who ran the industry in pre-vesting days and were, in his opinion, anti-nationalisationists.

Welcoming the resolution, Mr. J. Humphrey, for the executive, pointed out that for three years similar resolutions had been passed at the conference, but very little change could be seen except, perhaps, it had got far worse than it was at the beginning. Last year's conference resolution on the same subject had been sent to the Ministry of Fuel and Power who had done nothing except acknowledge its receipt. The motion would be carried as in the case of previous resolutions, but unless members were prepared to go back and work for its implementation they would be wasting their time, he stressed.

The Conference also adopted a resolution deploring the restricted capital expenditure on generating equipment, and calling for large scale expenditure financed by a reduction of compensation payments to shareholders.

A resolution asking for the same pay and conditions for generation and distribution workers employed outside the supply industry as those in it was carried, and the delegates also voted in favour of the revocation of Order 1305.

Registration of Apprentices

Other successful resolutions demanded the registration of apprentice electricians in any industry; that employers should be held responsible for the safe-keeping of tools left on a job overnight or at the week-ends; and the implementation of the Government policy of carrying out installation, repair and maintenance of Government works by direct labour.

Against the advice of the executive the delegates adopted a resolution calling for a unified and standard set of rates and conditions for the whole of the electrical industry, irrespective of geographical position, not less favourable than those operating in the London area, with 80% of the skilled rate and pro rata for unskilled.

In recognition of their outstanding long service to the Union, gold badges were presented to Messrs. W. Lilburn (Newcastle, 43 years), T. Gaynor (Birmingham, 40 years), C. Symes (Pontypridd, 48 years), and H. H. Morton (London, 40 years).

Sutton Coldfield T.V. Transmitter

Technical and Constructional Details described at I.E.E.

DESIGN of the Sutton Coldfield television station and its ancillary equipment formed the subject of a symposium of papers presented by various Authors to the Radio Section of the I.E.E. last Wednesday. The main paper, by P. A. T. Bevan and H. Page, dealt with the general design. The transmitting station was at the present time the highest-powered television station anywhere in the world. It contained two v.h.f. transmitters: a 42 kW vision transmitter and a 12 kW sound transmitter operating on carrier frequencies of 61·75 Mc/s and 58·25 Mc/s respectively, corresponding to Channel 4 of the British television service frequency-allocation plan for the band 41 to 68 Mc/s as shown in the diagram on page 832.

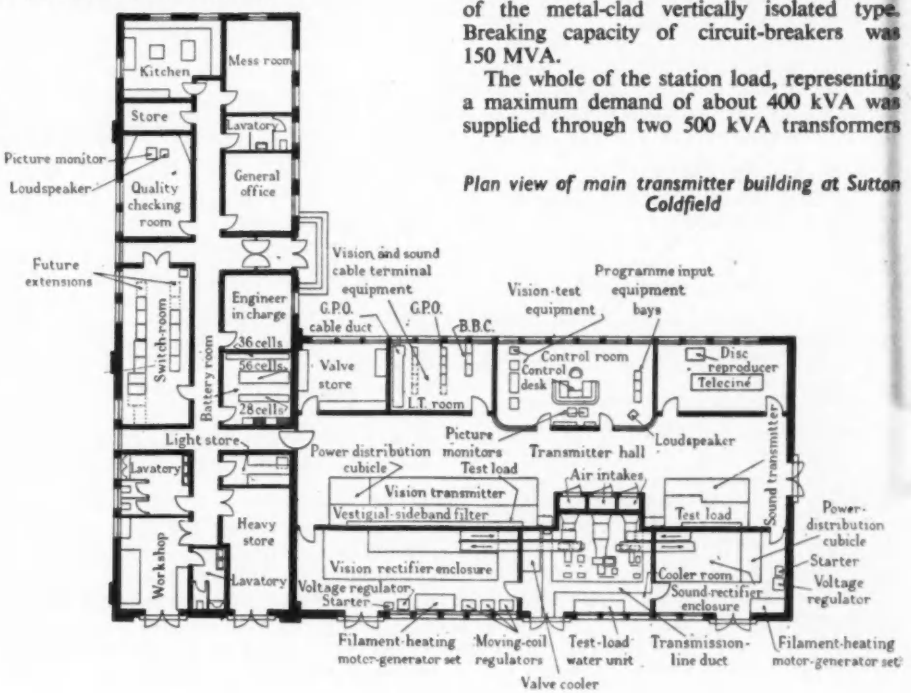
By adopting vestigial-sideband transmission for the vision programme, five independent channels had been obtained, which was considered to be the minimum number if the greater part of the population of the United Kingdom were eventually to receive a television service in this waveband.

It could be seen that, with the exception of Alexandra Palace, which occupied Channel 1 and was a double-sideband transmitter, the channel spacing between the Sutton Coldfield station and other future transmitters was 5 Mc/s and each had been allocated an effective overall channel width of 4·75 Mc/s. For each channel the spacing between vision and sound carriers was 3·5 Mc/s, the sound carrier being on the low-frequency side. The lower sideband of the vision signal was transmitted substantially unattenuated and with negligible phase distortion from a frequency 2·75 Mc/s below the carrier, while the upper sideband was subject to considerable attenuation for frequencies more than 0·75 Mc/s above the carrier. Both sound and vision were amplitude modulated.

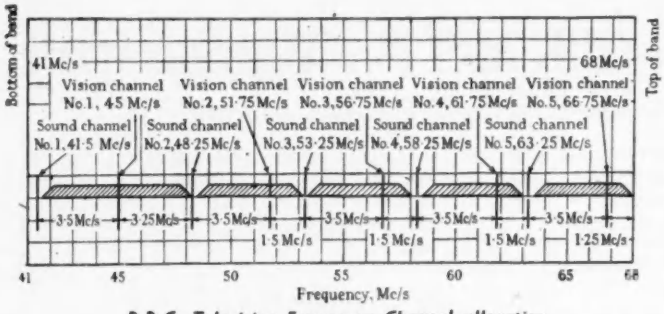
Power Supplies

Power was taken from the local 11 kV network of the East Midlands Electricity Board, through duplicate feeders. The 11 kV switchgear was built up into a six-panel switchboard of the metal-clad vertically isolated type. Breaking capacity of circuit-breakers was 150 MVA.

The whole of the station load, representing a maximum demand of about 400 kVA was supplied through two 500 kVA transformers



Plan view of main transmitter building at Sutton Coldfield



B.B.C. Television Frequency Channel allocation

with a normal ratio of 11 kV/415 V and with off-load tap-changing switches to give ±3% and ±6% adjustment. Although one transformer could carry the present load, normal practice was to operate the two in parallel during programme hours, and the protective equipment and breaking capacity of the 415 V switchgear had been designed accordingly.

The transformer bays and 11 kV switchroom formed part of the garage block, which was detached from the main transmitter building. Oil circuit-breakers for the 415 V system were located in the main building. These breakers were equipped with direct-acting over-current protection with time-limit fuses and with instantaneous restricted earth-leakage protection relays. Operation of these relays tripped both the 415 V and its associated 11 kV circuit-breaker. In addition inter-tripping was provided between the 11 kV and 415 V circuit-breakers to ensure that the transformers could not be energised from the 415 V busbars.

Vision Transmitter

The input to the vision transmitter was received from Alexandra Palace via Telephone House, Birmingham, the final link from Birmingham to Sutton Coldfield being over 11 miles of 0·975 in. diameter coaxial tube. A vestigial-sideband carrier system of cable transmission was used having a carrier frequency of 6·12 Mc/s, the upper sideband being partially suppressed.

The transmitter was of the high-power modulated type, modulation being applied to the grids of the final r.f. output stage. Four stages were used in the video frequency modulator. The first was a pre-amplifier which accepted a vision signal having an overall amplitude of approximately 1 V and a 70:30 picture/synchronising signal ratio. The output from this was coupled to the sub-sub-modulator which consisted of a single valve amplifier and cathode follower stage; this in turn was coupled to the sub-modulator stage, which had a peak output of some 1,400 V and this finally drove the modulator output stage consisting of four valves in parallel connected as a cathode follower.

The r.f. section had five amplifying stages, preceded by a self-contained drive unit consisting of a precision crystal oscillator and two stages of frequency multiplication. The output from this stage was amplified successively by a single-valve pentode stage, a push-pull tetrode stage and a push-pull earthed grid triode stage. Next were the final modulated output stage and the penultimate or driving stage, which comprised two ACT26 triode valves in a grid-driven push-pull Class C neutralised amplifier. The final output stage consisted of two CAT21 triode valves in a push-pull earthed-grid linear wideband parallel-line amplifier, and gave a peak output of 45 kW.

Sound Transmission

The sound transmitter was of the high-power Class B modulation type, and had six stages of modulation terminating in a pair of ACT14 air-cooled triodes driven by four DET21 valves in a push-pull cathode-follower circuit. The r.f. section consisted of a built-in crystal-drive oscillator unit followed by four stages of r.f. amplification. Two TT12 valves in push-pull drove a similar stage using four TT16 tetrodes, which were inductively coupled into the drive stage, consisting of two BR125 forced-air-cooled triodes in a conventional neutralised parallel-line amplifier. This was inductively coupled to the final output stage, which consisted of a single BR128 forced-air-cooled triode in an earthed-grid coaxial-line circuit giving an output of 12 kW (carrier 100% modulated).

The paper continued by giving detailed descriptions of the ancillary equipment, including the aerial (which was described in the *Electrical Times* of December 8, 1949).

Other Papers

Messrs. E. A. Nind and E. McP. Leyton gave a particularly detailed analysis in their paper of the vision transmitter, and explained the methods used for obtaining the required stabilised voltage supplies, and Mr. E. C. Cork dealt in detail with the theory and construction of the vestigial-sideband filter.

Problems and Practice
IN ENGINEERING

External Voltage

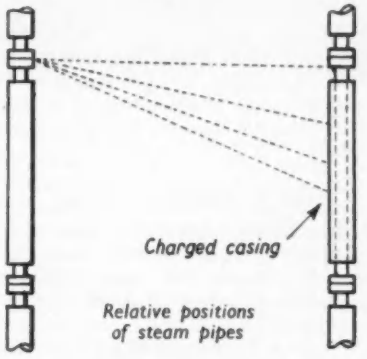
A SHORT time ago I was called upon to investigate a fault at a Council house in this area. The tenants reported that they were receiving slight shocks when washing their hands under the cold-water taps in the house.

On arriving at the house I made all the usual Megger tests from the dead side of the "splitter" switch fuse, an infinity reading was recorded in all cases, all lead cables were checked for bonding and the earth connection to the water mains inspected. All were found in good order, but on testing between the phase lead on the live side of switch fuse, and earth with voltmeter, no reading was indicated but a full 240 V was shown between neutral and earth. Upon further inspection, I found the 7/·044 lead sheathed cable feeding from the overhead service to the meter was bonded to the house installation, and this cable had become chafed where it connected to the overhead line with resultant earth between phase and lead sheathing, when this was corrected the fault was completely cured.—*G. A. Pearman, Golspie.*

Whose Responsibility ?

AT a colliery some men were working on the economisers of a range of Lancashire boilers, and when carrying long tubes they complained they received severe electric shocks when they or the pipes they were carrying came into contact with the metallic casing supporting lagging on a steam pipe rising from a boiler to the steam range. An electrician, sent to investigate, found that even after switching the power and lighting supply to the boilers, a spark was seen when the casing was discharged. Nonplussed, he sought help from his superior, who noticed that steam from a leaking joint was blowing directly on to the casing complained of about 9 ft away, the escaping steam being hardly noticeable due to the warm dry atmosphere. Also, he found the casing happened to be insulated from the steam pipe joint flanges and the combination of casing and steam pipe with the lagging between formed an effective condenser. When a piece of board was placed in the path of the escaping steam, he demonstrated to the amazement of the colliery mechanic that even with the power supply restored the casing could be safely touched.

His explanation of the cause of the casing



becoming charged and his refusal to accept responsibility for it certainly caused strained relations between the mechanical and electrical departments. As a temporary expedient the casing was earthed to the steampipe and the leaking joint was repaired much quicker than other joints had been attended to before.—*W. H. Rees.*

Switch Earths Circuit

I WAS called to a house by the local Council, my instructions being to "check wiring" —my subsequent inquiries with the tenant revealed that the whole of the lighting points would function correctly only when No. 2 bedroom switch was in the "on" position, which by trial I proved correct.

Control of the lighting installation was by double pole switch fuse, the fuse on the "red" outgoing feed of which was blown—replacing this fuse apparently put things right, but this of course did not satisfy me and a test was made to show that the incoming cable to the "red" side of the switch fuse was at earth potential, in fact the neutral of a s.p. and n. supply.

Accordingly therefore the two outgoing feeds were changed over to their correct position and the switch fuse operated, when the fuse immediately "blew."

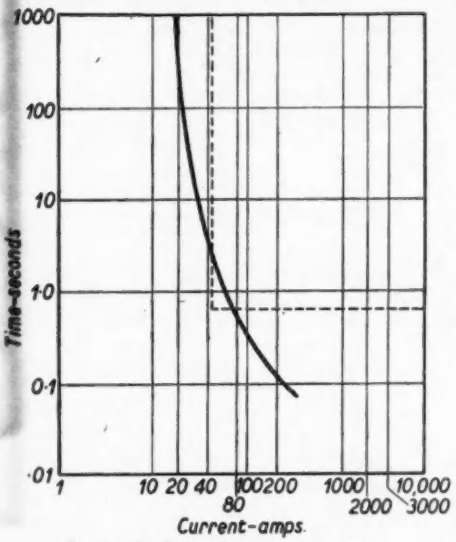
Attention was immediately switched to bedroom 2 switch, a standard semi-recessed

having its "dolly" mechanism "earthed" by the fixing screw to the metal box into which it was fitted, and examination of this revealed that part of the copper foil contact had broken away and fallen so as to bridge very securely the live switch blade mechanism to the "earthed dolly" mechanism; it will easily be understood that whilst this switch was operating on the neutral side the installation could operate satisfactorily with the switch in the "on" position and a "blown" fuse, and furthermore would operate normally when the fuse was replaced, but immediately the switch makes circuit on the phase side the switch is short circuited to earth. Replacement of the switch cured the fault which in all took 30 minutes.—*H. I. Petts.*

Rural Single-Phasing

AN h.v. circuit breaker protecting a radial feeder tripped out on earth leakage protection. The breaker was successfully reclosed and gave the indication of having tripped out on a transient fault.

A little later, however, it was discovered that a number of consumers fed from a sub-



Fuse and e.l. breaker characteristics

station on the overhead feeder route were without supply. A visit to the substation revealed the cause of the trouble; a tree branch had fallen across a pole mounting cable dividing box and blown an alloy-type fuse protecting the tee—only one of the fuses (supply was three-phase to the substation) had blown. The tree branch was examined and found to be badly charred and probably had the effect of limiting the fault current. A comparison of maker's curves for the fuse (20-amp) and the earth leakage protection on the c.b. indicated the reason for the faulty operation of the switch. The switch e.l. setting was 45 amp with a delay of ·6 seconds, the non-discriminating portion of the fuse curve was thus the portion intersected. In view of the fact that it was not possible to alter the percentage setting of the earth leakage relay nor the time delay, the "blind" portion of the curve had to be accepted.—*K. G. W.*

Tests for Commissioning

THE commissioning of electrical power plant requires that all plant must be up to standard for the operating conditions to be met in practice. The following tests relate to a 30 MW 6·6 kV 3,000 r.p.m. turbo-alternator and its associated cables and circuit-breaker equipment.

ALTERNATOR.—The phases were disconnected at the star point and one phase tested to earth at a time, the remaining two phases being earthed. The voltage was measured on an electrostatic voltmeter, which was verified against a standard gap to the satisfaction of the manufacturer's representative. Duration of each test one minute.

CABLES.—These comprised nine cables in all (three per phase) of 1·25 sq in. section, paper insulated and lead covered. Owing to the limited capacity of the testing transformer it was not possible to test all the cables at once. The three cables of each phase were therefore tested together, and the test repeated on the two remaining phases. The cables not under test were earthed. The cables were tested with 10,000 V to earth, this pressure being maintained for three minutes in each test.

OIL CIRCUIT BREAKER.—Two tests were made on each phase of the circuit breaker, being as under:—

Test 1.—Switch closed. Selector switch on bottom busbars. Top busbar contact earthed. Voltage applied to switch. All contacts earthed on the remaining two phases.

Test 2.—Switch open. Selector switch on top busbars. Alternator contact earthed. Voltage applied to top busbar contact and bottom busbar contact. All contacts earthed on the other phase.

A voltage of 26,000 V was applied between the part under test on each test, this pressure being maintained for one minute.—*C. B. Y.*

Cooling Large Generators

Design Features for Hydrogen Coolers

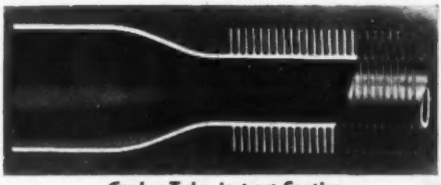
FOR generator cooling the advantages of hydrogen, as compared with air, arise from the different physical characteristics of the two gases. Not only does the lower density of hydrogen afford a significant reduction in generator windage losses, but also, because of its greater thermal conductivity, hydrogen reduces thermal gradients between adjacent parts of the machine. Furthermore, hydrogen has a higher coefficient of heat transmission and thus more readily absorbs and rejects heat in the cycle of the cooling system.

An important difference between hydrogen and air systems is that air-leakage into or out of an air system is relatively unimportant, but leakage in a hydrogen system has an adverse thermal and economic effect on performance. It follows, therefore, that for hydrogen both generator and cooling system must be gas-tight, and a convenient method of construction is to incorporate generator and hydrogen coolers in a single gas-tight casing.

On large generators one convenient method of arranging the hydrogen coolers is to group the units around the periphery of the stator yoke. In this arrangement which was first employed on the pioneer hydrogen-cooled generator in Great Britain—a 75,000 kVA 3,000 r.p.m. Metrovick machine installed in 1949 in the Littlebrook B station of the B.E.A. —the tubes are parallel to the axis of the machine, and the units are substantially of the same length as the generator.

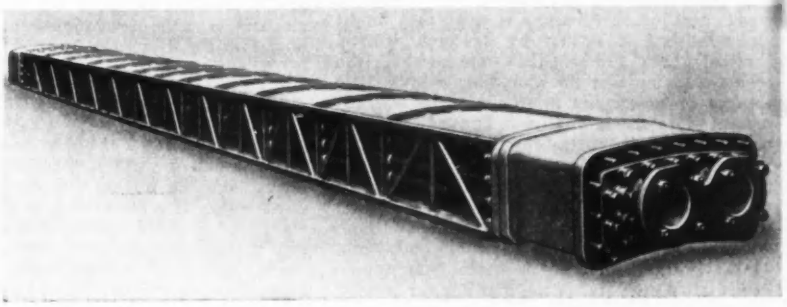
Metrovick Hydrogen Cooler Unit

A complete cooler unit, as used in two 75,000 kVA Metrovick generators installed at Littlebrook and in another machine that will soon be in service at Battersea, is shown below. The unit consists of a nest of finned tubes with water boxes and removable covers. Each tube is supported at frequent intervals along its length, and the ends are expanded into tubeplates. To enable individual tubes to be renewed, adjacent tubes are belled at alternate ends to a diameter greater than the fins and supporting collars. The cooler units are secured to the generator casing by special end mountings incorporating bonded rubber seals. These mountings, together with a flexible member at one end of each side frame, permit differential expansion between the tubes and casing.



Cooler Tube in part Section

Above is shown a portion of a cooler tube in part section. It will be noted that the tube is fitted with plain fins. Although tubes fitted with wire loops provide the most efficient surface for heat transfer, a plain finned tube is favoured for hydrogen coolers because it offers less resistance to gas flow, and therefore a higher gas velocity may be employed for a given pressure drop through the cooler. A high gas velocity permits a reduction in the radial width of the cooler units, and thus with installations where the units are grouped round the periphery of the stator yoke the diameter of the casing is reduced.



General view of hydrogen cooler removed from alternator

overseas news

Sweden's Output Up

Power consumption in Sweden last year amounted to 18,300 million kWh, averaging 2,600 kWh per head of the population. According to our latest reports, there are now only about 50,000 rural homes—some 5% of the total number—still without electricity. It is expected that a number of the hydro-electric generating projects will be completed by the end of 1954, by which time the total output should be about 25,000 million kWh.

Investigation in Tasmania

Tasmania's House of Assembly has decided to appoint a Select Committee to inquire into certain matters relating to the State electricity supply. The committee is to inquire into the present and prospective output of and demand for hydro-electric power in Tasmania; the reasons for the present power shortage: and whether any variation of the form of the present rationing system is desirable. The committee will also inquire into responsibility for contract commitments in excess of power now available, and what companies, firms, undertakings or classes of consumers have been connected to the power system and given a supply since first action to restrict power to those under contract. Justification for supply to any such new consumer and the policy best adopted to relieve the present power shortage and to avoid future shortages also will be investigated.

South Fremantle Nearly Ready

Latest developments at South Fremantle power house, Western Australia, indicate that the "A" station will be supplying electricity within a month. Tests of one 25 MW turbo-alternator have already been made. The station was recently inspected officially, by the State Minister for Works, Mr. Brand.

Survey of Power

A comprehensive examination of the electric power position in Australia is given in a report just published in Sydney by Research Service. Entitled, "The Power Crisis in Australia," the report explains that the Commonwealth's basic sources of power are more than adequate for present foreseeable needs. The sources are petroleum, black coal, brown coal, and water power, with black coal as the most important of these. In Australia and New Zealand there are 4,000 million tons of proved and 15,000 million tons of probable reserves, and in addition, Australia has 6,000 million tons of proved and 44,000 million tons of probable brown coal deposits. At the end of the first quarter of 1950 generating plant capacity totalled 2,123,337 kW. Plant under construction will, when completed, raise the total to 3,700,138 kW, and it is anticipated that by 1958 the figures will be raised to 5,574,538 kW. These figures exclude the vast Snowy Mountains scheme. The report then goes on to deal with the post-war power shortage, expressing the opinion that the major cause for this has been failure to complete plans rather than hesitation in making them, instance being given of a number of new projects, for which the generating plant has been placed in store awaiting the completion of building work. The real problem is to maintain the present planned schedule of major installations. Small emergency plants will not help much, concludes the report.

More Locos for N.S.W.

The New South Wales Government Railways has ordered ten diesel-electric shunting and transfer locomotives from the British Thomson Houston Co. Ltd. The order was placed through the British firm's Australian agents. Australian General Electric Pty. Ltd. The locomotives weigh 70 tons each, develop 1,000 b.h.p. and have a maximum speed of 57 m.p.h., it is stated.

Another Project

In Quebec a few days ago, Premier Duplessis stated that government technicians were seriously considering a plan to develop 200,000 h.p. in the town of Gaspe itself with an electric-power plant burning Nova Scotia coal as its source of energy. Until now, the Government had planned harnessing the Madeleine River to provide electric power for the copper development undertaken by Noranda Mines Ltd. However, the river could only produce a maximum of 25,000 h.p., and the idea had been scrapped. Another suggestion that more hydro-electric power be developed on the St. Lawrence north shore to provide the power needed on the south shore Gaspe peninsula has also been dismissed. Another phase of the electrification programme will probably involve an increase in the development of hydro-electric power on the Rimouski River.

St. Lawrence Scheme

Calling for an immediate start on the St. Lawrence power development, Mr. R. H. Saunders, chairman of the Hydro-Electric Power Commission of Ontario, has declared that it is urgent that the way be cleared within the next few weeks. He revealed that he had received discouraging news from both Ottawa and Washington during the past few days which made it appear the development would be postponed again for another year. He has asked the federal

government formally to advise the U.S. that Canada is prepared to go ahead alone, if necessary, with the power development, and has intimated that the Commission is willing to contribute $160 million as its share of the cost.

Power Labs Opened

The power and high-voltage engineering laboratories of the Indian Institute of Science at Bangalore, were opened last month by the President, Dr. Rajendra Prasad, who, at the same time laid the foundation stone of the Civil and Hydraulic Engineering laboratory of the Institute. The Director of the Institute, Prof. M. S. Thacker, explaining the objects of the new department, said the power engineering section would provide instruction to engineering graduates of Indian universities for two years, including a period of practical work outside, and short refresher courses for professional engineers. In the electrical laboratories a network analyser, the first of its kind in India, has been installed. The facilities of this machine have been made available to the Central and State Governments and various electricity authorities in the country. The Bombay Government made use of the equipment in connection with the Koyna Valley scheme.

Telecommunications Development

A five-year plan costing Rs. 10 million for development of India's external telecommunications service has been approved by the Standing Advisory Committee attached to the Ministry of Communications. The plan envisages the opening of a new wireless station in Calcutta, and the expansion and modernisation of existing stations in Delhi, Bombay and Madras.

The Wayward Pylon

One of the freaks of the floods in the South Canterbury district of New Zealand's South Island, last month, resulted in a break in the 11 kV power transmission line between Waitaki generating station and Christchurch. Two power lines cross the Orari River, each supported by two steel pylons. Engineers of the State Hydro-Electric Dept., investigating the fault, were amazed to find three pylons where there should have been only two. The explanation was that one of the two pylons upstream had been undermined by the flood waters and, breaking away, drifted downstream on its concrete base and in an upright position for a distance of six chains, until it joined the other two pylons! The task was to transport it back to its original position.

Tekapo Nearly Ready

The New Zealand State Hydro-Electric Department expects that the new Tekapo power station, with its 25,000 kW generator, will be feeding power into the main South Island grid this month. The plant, however, is only part of a scheme designed primarily to benefit the major station on the Waitaki River near Kurow.

Bulawayo's Expansion

Two new cooling towers, 180 ft high, for the extension of the Bulawayo power station, are to be constructed by the end of next year. The towers will be of 1,250,000 gal/hr capacity. Mr. A. R. Gibson, city electrical engineer, has said that construction of two more towers of the same size is being considered by the Council. These would complete the cooling tower installation on the 13th Avenue site. Mr. Gibson, by the way, has prepared a load shedding plan, splitting the territory into three zones, to be put into effect when necessary.

Power on the Reef

First arrange for power supplies, is to be the advice given in future by Vereeniging Town Council to industrialists seeking sites for new factories. This has been decided upon following the meeting, a few days ago, between a deputation from the council and executives of the Electricity Supply Commission of South Africa. The latter had emphasised that electric power supplies for new industries on the Reef (excluding Johannesburg) would not be approved unless the commission's screening committee was satisfied that the new projects were in the national interest. For the council it was emphasised that they had recently sold sites to two major industries and several smaller companies. The deputation was told that the position was extremely critical and that, although in this case a concession would be made to the council because it had committed itself, no new land was to be sold to industrialists until the commission's approval had been obtained. The present acute shortage is likely to exist for at least two years.

Staff Shortages

Nearly 14% more units were generated at the Port Elizabeth municipal power station last year than in 1949, Mr. D. A. Bradley, city electrical engineer, records in his report for 1950. He stated that the installation of the first of two new 80,000 lb/hr boilers made it possible to shut down other boilers, individually, for overdue repairs and renewals. Other additional equipment which has improved efficiency and saved money is the mechanical gear for removing ash from the boiler house, Mr. Bradley reports. The power station suffered serious staff shortages during the year, and there is still a dearth of skilled mechanics in the meter test branch. The shortage of artisans and shiftmen has caused a great deal of overtime.

Tariffs up in Gib.

Gibraltar, too, has been affected by rising costs. Following the recommendations of the Standing Committee on Public Utilities, the city council has increased charges for electricity. The light and multi-tariff has been raised from 6½d. to 7¾d. p.u., power from 3½d. to 4¾d. p.u., and secondary power from 1d. to 1¼d. per unit.

PERSONALITIES

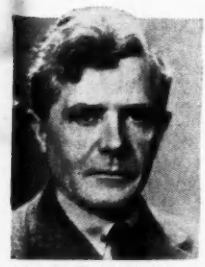
IN THE INDUSTRY

Recently elected President of the Illuminating Engineering Society for the ensuing year (to take office in October) is **Mr. J. G. Holmes,** A.R.C.S., B.Sc., D.I.C., F.Inst.P., of Holophane Ltd. The vice-presidents will be **Dr. W. J. Wellwood Fergusson** (consulting ophthalmic surgeon), **Mr. A. G. Higgins** (asst. sec. Instn. of Gas Engrs.), **Mr. E. C. Lennox,** M.I.E.E., manager, Wear Sub-area, North Eastern Electricity Board, **Mr. L. C. Rettig,** of R. W. Gregory and Partners, and **Dr. W. S. Stiles,** of the N.P.L. Mr. Holmes is in charge of the laboratories of Holophane Ltd. He has acquired special knowledge of the manufacture of glass, and is regarded as one of the leading scientists in the lighting industry. The name of Mr. Lennox, too, is well known to lighting engineers—he was for 10 years chairman of the E.D.A. street-lighting committee, and he has been prominently associated with the work of the Association of Public Lighting Engineers, of which he was President in 1936-37.

Mr. J. G. Holmes

A keen member of the Soroptomist movement, **Miss Mary Gilbert,** Women's Press Liaison Officer, of the British Electrical Development Association, has been elected President for 1951-52 of the London and South Eastern Counties' Divisional, Union Council, which comprises 24 clubs.

The Association of Supervising Electrical Engineers announce that **Mr. T. G. N. Haldane,** M.A., M.Inst.C.E., M.I.E.E., Fel.A.I.E.E., M.Cons.E., has accepted an invitation to continue as President of the Association of Supervising Electrical Engineers for a second year. Mr. Haldane, who succeeded Mr. A. G. Ramsey, O.B.E., B.Sc.(Eng.), M.Inst.C.E., M.I.E.E., M.I.Mech.E., in October, 1950, will deliver his second Presidential address at the opening meeting of the Association's London National Lecture session on October 16. Mr. Haldane is, of course, a partner in the firm of Merz and McLellan.



Mr. T. G. N. Haldane

A director of Siemens Electric Lamps and Supplies Ltd., **Mr. S. H. Callow** retired recently, but his activities in the electrical industry have not ceased completely, however, as he is continuing to serve on several committees. Mr. Callow entered the service of Siemens Brothers Dynamo Works Ltd. in 1907, and his long association with the manufacture and sale of lamps began in the following year, about the time that Siemens were manufacturing the first tantalum lamps in this country at their Dalston works. Mr. Callow has been associated with Siemens Electric Lamps and Supplies Ltd. since its formation. He was appointed general manager of that company in 1923 and in 1926 was made a director. Members of the firm entertained Mr. Callow recently when he received presentations from the staffs at Upper Thames Street, Caxton House and Preston factory. For some years Mr. Callow has also been a senior executive of Siemens Brothers and Co., Ltd., particularly in connection with cable interests. Some of the directors and senior executives of that company also made a presentation to him on his retirement at a special function held in his honour at Woolwich.

Mr. S. H. Callow

Already holding the distinction of being the only person to have twice held the office of President of the Illuminating Engineering Society, **Dr. J. W. T. Walsh** has joined a further select band by the award to him of honorary membership of that society. Dr. Walsh is now a senior principal scientific officer in the Light Division of the N.P.L., and is known internationally for his work on photometry, and in connection with the International Commission on Illumination, of which he was made a vice-president in 1948. Since 1945, he has been chairman of the National Illumination Committee of Gt. Britain, and of the Illuminating Industry Committee of the British Standards Institution.

Dr. J. W. T. Walsh

Nominated as chief generation engineer (operation) to the East Midlands Division of the B.E.A., as from June 1, is **Mr. O. S. Woods**, A.M.I.E.E., A.M.I.Mech.E., now generation engineer (operation), No. 3 Sub-Division of the North-Western Division, succeeding the late Mr. P. Ormiston. Mr. Woods was resident engineer at the Barton generating station of Manchester Corporation prior to vesting day, having earlier served for four years as assistant resident engineer at the West Midland J.E.A.'s Ironbridge station. Educated at the Rugby College of Technology, and Regent Street Polytechnic, he was trained at the B.T.H. works at Rugby, and afterwards went to Battersea station of the London Power Co. He became technical assistant to the chief electrical engineer (generation) of the London Passenger Transport Board in 1940, and was promoted to assistant resident engineer to the Board's Neasden station a year later prior to going to Ironbridge.

Mr. O. S. Woods

We now publish below, photographs of the three new Divisional controllers of the B.E.A., whose appointments we briefly noted last week. **Mr. H. V. Pugh**, M.I.E.E., M.I.Mech.E., now South Wales Divisional Controller, is to take up a similar post with the London Division on the retirement of **Mr. J. N. Waite**, C.B.E., M.I.E.E., F.Inst.F., at the end of this year. **Mr. L. F. Jeffrey**, B.Sc., M.I.E.E., M.Inst.C.E., M.I.Mech.E., now chief generation engineer (construction), Midlands Division, is promoted to controller of the East Midlands Division on the retirement of **Mr. W. S. Burge**, M.I.E.E., who is leaving that Division at the end of this month. Thirdly, **Mr. H. J. Bennett**, A.M.I.E.E., now chief generation engineer (operation), London Division, is to be controller of the South Wales Division in succession to Mr. Pugh. Born in India, Mr. Pugh was trained at the Trafford Park works of Met-Vickers, with whom he was later engaged in commissioning and operating of mechanical plant. In 1930 he joined Cory Bros. and Co., Ltd., in South Wales, where he was responsible for two power stations, and in 1935 he was appointed deputy station superintendent at the Upper Boat power station of the South Wales Power Co., becoming superintendent of that plant in 1937, and of the new Llynfi generating station in 1942. From September 1944 till vesting day, he was deputy chief engineer of the Manchester Corporation Electricity Department. Mr. L. F. Jeffrey gained early training with Keith Blackman and Co., and after serving in H.M.S. *Warspite* in the first world war, was assistant mechanical and electrical engineer at the Beckton Works of the Gas Light and Coke Co. for three years. After 11 years as assistant constructional engineer, Birmingham Electric Supply Dept., he joined the West Midlands J.E.A. in 1936 as technical assistant and construction engineer, becoming deputy chief engineer in 1938, chief engineer in 1942, and a senior executive officer in 1948. Mr. H. J. Bennett entered the industry in 1921 as a junior engineer with Portsmouth Corporation, and became charge engineer at the Bargoed station of the Powell-Duffryn Co. In 1926 he joined the Lancashire Electric Power Co. as senior charge engineer at Padiham power station, but returned south in 1928 as charge engineer at the Deptford West station of the London Power Co. In 1933 he transferred to the company's Battersea station, where he successively held various positions, being eventually promoted to the chief assistant engineer (generation) at head office in 1948, just before taking up his B.E.A. Divisional post.

Mr. H. V. Pugh

Mr. H. J. Bennett

Mr. L. F. Jeffrey

Following the recent announcement that Mr. W. Puckey, director and general works manager, Hoover, Ltd., will be "on loan" to the Government as deputy controller of supplies (air), certain changes have been made on the engineering side of Hoover Ltd. Until the return of Mr. Puckey, **Mr. B. H. Dyson** has been appointed deputy general works manager, supervising all production. **Mr. W. J. Dimmock** has been nominated works manager of the Perivale factory. **Mr. A. Fisk** becomes chief planning engineer, **Mr. E. I. Laver**, chief tool designer and **Mr. H. J. Lloyd**, assistant chief planning engineer.

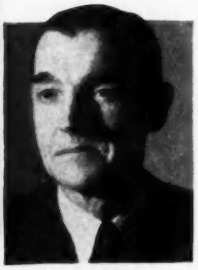
With the greatly increased application of electrical equipment in hospital practice, the Minister of Health has appointed **Mr. H. C. Davies**, A.M.I.E.E. (formerly with the Ministry of Supply) and **Mr. C. A. Powell**, A.M.I.E.E. (previously with the L.C.C.) to look after electrical safety in hospitals. Both have had experience in developing and applying precaution and safety techniques in engineering matters in explosive environments. They are to advise hospital authorities in these and related matters, such as shock risks.

Leaving the East Midlands Division of the B.E.A. at the end of this month, **Mr. W. S. Burge,** M.I.E.E., divisional controller (whose impending retirement we briefly noted last week), will have completed 50 years' service in the electrical industry. For, starting in 1901, he spent 14 years obtaining practical experience in the manufacture, erection and operation of power-station plants, serving during that period with Parsons, Dick Kerr, B.T.H., Reyrolle, Ferranti and Wakefield and Southampton undertakings. After war service he joined the English Electric Co., with whom he specialised on steam turbine work and twice visited the U.S.A. From 1930 till vesting day he was associated with the Central Electricity Board, originally as operation engineer in the S.E. England district, and ultimately as manager of the Central England district, succeeding another well-known engineer, Mr. S. T. Allen.

Mr. W. S. Burge

Commander C. F. Nock, D.S.O., R.N. (Retd.), sales director of Tuscan Engineering Co. and Tuscan Industries Ltd., has resigned from the boards of both companies, we understand. Inquiries for the time being should be sent to the head office of the company at Bridgend, Glamorgan, or to Tuscan Industries Ltd., at 100 Lough Road, Holloway, N.7.

London Transport announces several changes in organisation in the office of the electrical engineer. **Mr. H. Branton,** previously generating station superintendent at Neasden, has been appointed generating station superintendent at Lots Road. Mr. Branton, who is an officer of the Executive, joined the Metropolitan Railway in March 1930, as assistant resident engineer at Neasden, becoming resident engineer three years later and assistant electrical engineer in charge of the station in 1940, a position redesignated generating station superintendent in 1950. **Mr. W. Ward,** assistant generating station superintendent at Lots Road succeeds Mr. Branton as generating station superintendent at Neasden. He is well familiar with that station having earlier occupied the positions of maintenance engineer, shift engineer and resident engineer there. He was appointed assistant generating station superintendent Lots Road, on May 1, 1950. **Mr. D. S. Ryall,** A.M.I.E.E., assistant distribution engineer (Trams and Trolleybuses) Northern Division since 1949, has been appointed substations engineer. He entered the service of the London Electric Railway Co. in 1923, in the substations section, and in 1941 became mains assistant in the H.T. Mains Section and in 1946 assistant mains engineer. **Mr. G. H. Long,** assistant distribution engineer (Trams and Trolleybuses) Southern Division, has been appointed electrical equipment engineer in charge of Northern and Southern Electrical Divisions (Trams and Trolleybuses). He started with the L.C.C. Tramways Department in 1925 in the Substations Section and transferred to the Tramways Mains Section in 1935, as a mains inspector, and subsequently held the positions of assistant divisional engineer and assistant distribution engineer (Trams and Trolleybuses).



Mr. H. Branton

In these days of increased farm electrification, it is fitting that **Mr. F. E. Rowland,** M.I.E.E., M.I.B.A.E., M.A.S.A.E., manager of the agricultural department of the General Electric Co., Ltd., has been chosen as the new President of the Institution of British Agricultural Engineers. He is, of course, a well-known authority on the application of electricity to agriculture. He, in fact, started the agricultural department of the General Electric Co., Ltd., in 1929, and has been associated with the initiation of new uses of electricity in that field.

Mr. F. E. Rowland

Another who recently retired is **Mr. Percy Ridings,** M.I.Mech.E., generation engineer (operation), No. 2 sub-division in the North Western Division of the B.E.A. Apprenticed in mechanical engineering, he gained technical education at the Manchester College of Technology. From 1910 to 1916, he was engineer-in-charge at Middleton, after which he spent two years at Oldham as assistant electrical engineer. Then began a thirty-year association with the Lancashire Electric Power Co., during which time he rose from senior charge engineer to resident engineer at Kearsley generating station.

At present Head of the Electrical Engineering Department of the Northampton Polytechnic, London E.C., since 1948, **Dr. J. S. Tait** A.R.T.C., B.Sc (Eng.)., Ph.D., A.M.I.Mech.E., A.M.I.E.E., has been appointed Principal of Woolwich Polytechnic and will take up his new duties on September 5.

OBITUARY

Mr. R. Mitchell, station superintendent at St. Swithin's generating station, Lincoln, East Midlands Division, B.E.A., died last Friday, aged 53, Prior to going to Lincoln he was superintendent at Harrogate power station.

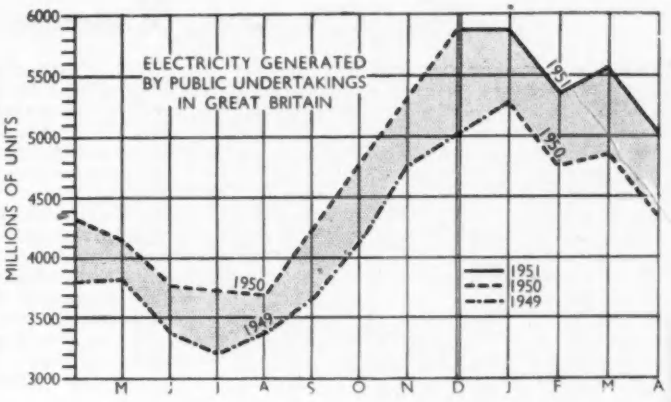
Mr. E. Evans, assistant secretary to Belliss and Morcom Ltd., died on May 9, aged 61.

UNITS GENERATED

5,015 million units was the total generated during April in stations under the control of the B.E.A., the North of Scotland H.E. Board, and the Lochaber Power Co. The corresponding figure last year was 4,302 million, so there has been an increase of 16·6%.

Of the total, 4,871 million units was generated in steam stations and 127 million in hydro-electric.

Energy sent out during the month was 4,735 million units, 94·4% of that generated. This gives the total for 1951 so far as 20,661 million units, an increase of 14·2% on the corresponding period of 1950.



POWER SUPPLY IN APRIL

FOLLOWING last month's commissioning of its first boiler, Skelton Grange power station (Leeds, Yorkshire Division) became effectively operational during April, with a 60 MW Parsons turbo-alternator. The machine generates at 11/15 kV, and is powered by a three-cylinder turbine, stop valve conditions 900 lb/sq in, 925° F. This is the only addition to output capacity recorded for April, and down-rating and scrapping of plant were sufficient to reduce the effective installed capacity at m.c.r. by 51 MW, to 14,588 MW.

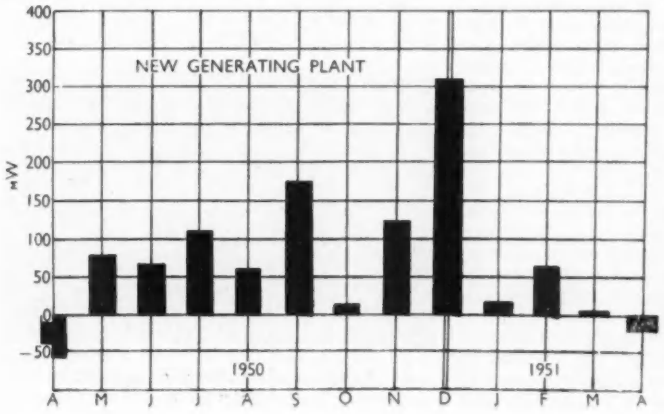
Steam Generation

High proportional increase in units sent out compared with last year continues, and the breakdown shows 16·7% more energy generated by steam power than in April 1950, and 12·4% more by water power. Corresponding overall figures for the year so far are 14% and 15·6%.

Fuel Totals

The 16·7% increase in steam energy has entailed the consumption of 15·2% more coal, actual figures being 2,861 thousand tons this April against 2,484 thousand tons for April 1950. Additional fuel used included 73 thousand tons of coke.

Oil engines continue to supply a rapidly increasing number of units. In April 1949 the total was 5·6 m. units, in 1950 9 m. units, and this year 11·7 m. units. Oil consumed has correspondingly increased: 3·8 thousand tons, 5·3 thousand tons and 8·3 thousand tons being the appropriate figures.



GENERATING PLANT

At the end of March, 1950, the installed capacity of the B.E.A. was 14,588 MW, showing a decrease of 51 MW during the month. In the same period the North of Scotland total increased by 32 MW to 561 MW. The figure for overall increase during the last twelve months becomes 991 MW, or 7·0%.

The total installed capacity used for the purpose of this graphshould be distinguished from the output capacity. The installed capacity is the total m.c.r. of all the generating sets which are connected on both steam and electric sides and are suitable for service.

Weights and Measures

IN 1949 a Committee was established to "review the existing Weights and Measures legislation and other legislation containing provisions affecting Weights and Measures and the administration thereof, and to make recommendations for bringing these in line with present-day requirements." The report of this Committee was made available last Friday (H.M.S.O. Price 3s. 6d.), and in view of the importance of its recommendations, which, if accepted, will affect the whole of the population, we summarise them below.

Apart from the requirement of consolidating and clarifying the existing complex legislation, it is proposed that the Government should take steps in concert with the Commonwealth and the U.S.A. to abolish the Imperial system of measurements in favour of the complete adoption of the metric system over a period of about twenty years. If this is not acceptable, the Imperial yard should be defined as 0·9144 of the International Metre, and the Imperial Pound as either 0·45359237 or 0·4535923 of the International Kilogramme exactly; and that the U.S. Government should be informed of these proposals at an early date in the hope of securing identical values for the yard and pound in both countries.

A Commission should be appointed by the President of the Board of Trade to advise on all matters relating to units and standards, and in particular on the definition in law of the units of time, capacity, temperature, heat and electricity; the nature and construction of primary standards and their copies, and the frequency of checking and comparison of these standards and copies; matters arising out of the work of the International Conference of Weights and Measures, and additions to or deletions from the schedule of lawful units.

Among many other recommendations dealing with weighing and measuring equipment, it is proposed that gas and electricity meters should continue to be exempted from Weights and Measures Control.

MORE BRITISH POLYSTYRENE

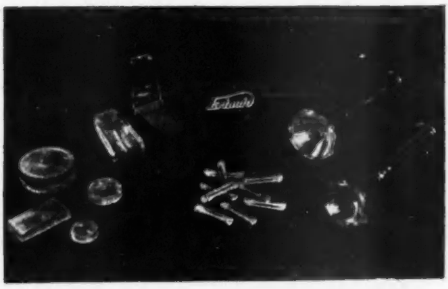
The new Partington plant

UNTIL comparatively recently, polystyrene was imported from America, the first British plant having been inaugurated about a year ago (ELECTRICAL TIMES, July 13, 1950, p. 75). Further developments in British manufacturing have been undertaken by Styrene Products Ltd., a company jointly owned by Petrochemicals Ltd. and Erinoid Ltd., the latter a familiar name in the electrical industry for several decades.

The new plant, engineered and constructed by Petrocarbon Ltd., is located at Partington, near Manchester, and is now in full scale production, having a capacity of some 5,000-6,000 tons/year. At present monomeric styrene, the raw material, is imported from Canada; but it is intended that it will eventually be manufactured in Britain from raw materials obtained from the adjacent plant of Petrochemicals Ltd. Research is in the hands of Erinoid Ltd. and Petrocarbon Ltd., and marketing of the products is being conducted by Erinoid Ltd.

Properties

Polystyrene, as is generally known, is a clear tough thermoplastic material which is unaffected by moisture, with a tensile strength of 6,000-8,000 lb/sq. in., and a power factor of approximately 0·0002-0·0004 at 1 megacycle, a dielectric constant of 2·55 and a breakdown voltage of 600 volts/mil. Classed as a slow burning material, it softens at 195-220° F, is readily cemented and easily machined, and has a high resistance to moderately concentrated acids, salt water, chemical soaps, oils and alcohol. It is normally available in the form of moulding powder, sheet, and rod in a wide variety of colours. Applications in the past have included a number of electrical uses, including battery cases, coil formers and the like, apart from its share in the construction of refrigerators and other domestic apparatus. Increased availability will, no doubt, greatly extend its uses.



A number of mouldings produced from polystyrene

Electronics in the Laundry

TWO recent applications of Osram photo-electric cells in the laundry of James Bentley, Ltd., of Wilmington, Kent, include the automatic folding of sheets, and the saving of fuel during slack periods on the drying conveyor.

The sheet, emerging from an ironer, is fed on to a number of parallel belts. When it has moved forward a few inches, the leading edge of the sheet intercepts a beam of light falling on to a p.e. cell and operates pneumatic grippers arranged across its path, which hold it slightly above the belts. As the remainder of the sheet is still moving forward a fold is created.

When the trailing edge of the sheet uncovers the light beam, a relay mechanism releases the gripper fingers and the two edges of the sheet fall together and a perfect fold is completed.

Photo-electric cell on sheet folding machine

After the washing processes, the clothes are passed through a drying room heated by means of a steam radiator and a fan.

A light beam is arranged to project across the room on to an Osram photo-electric cell, and so long as the beam is obscured by clothes passing around the room on a conveyor, the fan continues to run. If, however, there is an interval between batches of work and the beam is unbroken, the photo-electric cell shuts down the fan, which in turn leads to a substantial drop in the steam consumption of the radiator. When more clothes come along the fan automatically re-starts.

E.I.A. DISCUSS THE BUDGET

"INDUSTRY and the Budget" was the subject of an address given last Thursday at a London Regional meeting of the Engineering Industries Association, the speaker being MR. J. R. MEAD, A.C.A. (chairman, Financial Problems and Taxation Committee, E.I.A.).

Manufacturing industry had a three-fold task, said Mr. Mead. On top of normal domestic production, first exports then rearmament had been superimposed. The Budget made a fourth superimposition, and he proposed to analyse, objectively and non-politically, the additional burden which was thrust on industry. Admittedly, it might have been much worse—there was, for example, no tax on capital appreciation, no capital levy and no apparent increase in surtax, but its effects were no less serious when analysed.

Most important provision of all was the suspension of initial allowances on plant, machinery and industrial buildings, which amounted to a curtailment of capital investment, and the firms who were expanding production for important export or defence markets were the hardest hit. The problem of inflation was now greater than before and the F.B.I. recommendations on the use of present-day values had not been taken into account in the Budget. The Chancellor's reference to firms on rearmament work not being allowed to suffer could only be interpreted as a revival of the Plant Assistance schemes, with the Ministry of Supply building up large pools of machines for hire. This, however, would not suffice to prevent disruption of future planning by industry and the position was more serious than was realised.

Regarding the increase in profits tax from 30 to 50% on distributed profits, he pointed out that with rises in wages and raw materials manufacturing costs were bound to go up and more money was required. The policy of restricting profits put serious restrictions on the availability of "venture" capital. Industry was actually in the position of a man being urged to make extra physical effort and be a blood donor simultaneously.

While the increase in standard rate was not so bad as it might have been, coupled with the other items it fell as an extra burden on industry. Not only he himself, but the E.I.A. Taxation Committee marvelled at the way engineers shouldered additional tasks without squealing. He then indicated to the meeting the steps which the E.I.A. were taking in regard to the Royal Commission on Taxation (the Cohen Committee), under the headings of general sociological recommendations, and on the technical aspects of the problem.

D

The BUYER'S *Column*

Price Changes

CHECKING up on other recent changes of prices due to shortage of raw materials and other consequent increased costs, we note that LINOLITE LTD., 158 Bishopsgate, E.C.2 have increased prices as from April 18 by 5%

THE GENERAL ACCESSORIES CO. LTD., Barton Hill Works, Bristol 5, have revised the price of electrical accessories shown in their 28th edition catalogue. New retail prices became effective on 30th April, 1951, and are summarised in new lists available from the company.

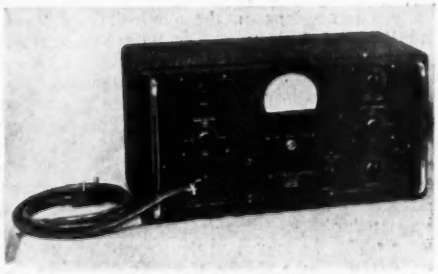
E. K. COLE, LTD., Southend-on-Sea, Essex, have recently issued a new price list for "Thermovent" convector heaters and "Thermotubes" tubular heaters. These prices were effective as from May 1st.

In a recent notice issued by THE WARM GLOW CO., LTD., 113 London Road, Leigh-on-Sea, Essex, the company points out that due to raw material shortages the model DW is suspended. White covers are no longer available. The blanket cloth used on their models is now wool/cotton (72% wool.) Prices are adjusted to current costs.

The Addison Induction Tracer improved

SEVERAL improvements have been effected in the design and construction of the Addison Induction Tracer since we wrote about it in May of last year.

This unit type 154A is made by the ADDISON ELECTRIC COMPANY, LTD., 163, Holland Park Avenue, Kensington, W.11, and is a self contained portable unit comprising in a smaller carrying case two special detector coils a three stage amplifier and lightweight piezzo-electric headphones. A linear or selective frequency response may be employed, a new feature being the directly calibrated depth measuring circuit. Yet another new feature is the detachable lid which houses one of the detector coils and with its carrying handle facilitates the routing of concealed conductors.

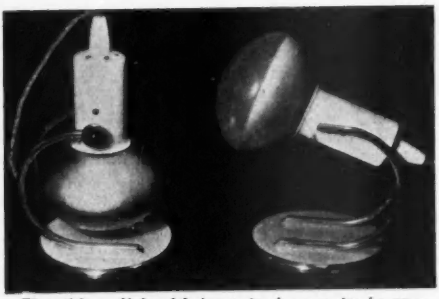


This new oscillator is designed for use with the Addison Induction Tracer

An important addition to the tracing equipment is a powerful mains or battery operated oscillator, housed in a strong pressed steel case, for injecting a pilot current into the cable or pipe line under test. An operating frequency of 200 to 1,000 cps may be selected and an output matching transformer has been provided. A special feature is a keying circuit which gives a distinctive quality to the signal making it easily distinguishable from external interference.

3-in-1 Ray Therapy Lamp

RECENTLY announced by "V" (DEVELOPMENT AND TRADING), LTD., 14 Clifton



The "Neron" health lamp is three units in one.

Gardens, W.9, is their new "Neron" Ultra Vitalux Irradiator, incorporating ultra-violet, infra-red and light radiation units in a single glass bulb.

No transformer, resistance, starter or "warming up" period is required for the new lamp, and immediate full output it is claimed is secured when switching on.

An important feature is that the bulb has a parabolical interior reflector, thus dispensing with any additional reflector.

An outstanding improvement in the lamp is that the mercury high-pressure quartz burner is enclosed in a special filter glass which absorbs ultra-violet rays below 2,800A, whilst the therapeutically important ultra-violet medium waves between 2,800 and 3,150A pass through. The mercury burner, combined with a tungsten filament, gives a radiation effect almost identical to the natural sunshine.

The lamps are available for 220 to 230 V a.c., the total consumption of the three radiation units being 300 W. Weight is 8 oz.

The lamp is supplied with a specially designed stand, overall height 11 in.; weight complete with lamp 3 lb. 6 oz. This attractive stand can also be used as a wall fitting. When not in use the lamp is lowered towards the protective base.

It is suitable for local or general radiation of the body.

On Show at the Festival

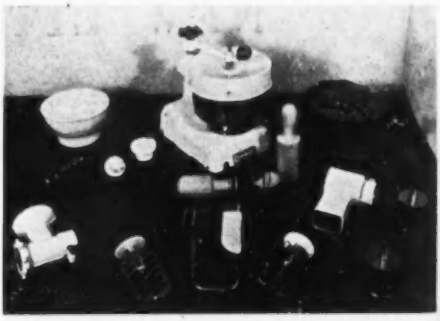
THE R.L.M. dispersive reflector produced by BENJAMIN ELECTRIC, LTD., Brantwood Road, Tottenham, N.17, is being shown in the Hall of Illumination at the Festival of Britain as being characteristic of a direct lighting fitting complying fully with B.S.S. 232 and with the I.E.E. wiring regulations.

Benjamin's are naturally proud of this fitting, which has the Saaflux system of reflector construction and is finished in "Crysteel" vitreous enamel. In the Dome of Discovery at the South Bank Site, WATSON AND SONS (ELECTRO-MEDICAL) LTD. (an associate company of G.E.C.) are showing their cine-radiography apparatus. This apparatus—believed to be the only one of its kind—is used for making X-ray cinematograph films of any part of the body. It offers great possibilities in furthering medical knowledge by permitting the leisurely study of the mechanics of moving joints and organs.

The high-power generator and rotating anode X-ray tube used in conjunction with a specially designed cine-camera and lens have made possible a very high standard of radiographic quality.

The equipment was developed in collaboration with Dr. Russell J. Reynolds and was made to the order of the Ministry of Health.

Festival Exhibits by Benjamin (right) and Watsons (below)



"Lammix" Developments

A BRITISH domestic aid which has made a hit in the States is the "Lammix" kitchen helper, produced by HUWOOD COMPONENTS LTD. 1 Glasshouse Street, Newcastle-on-Tyne 6.

Available now for operation with the machine are the following accessories:—mixing bowl, whisking bowl, whisking unit, platform for whisking bowl, juice extractor, wooden mixing 'dolly', two-prong scraper, dough hook, flat beater, wire 'dolly' whisk, potato peeler, grater plunger, grater unit, fine grater, coarse grater, slicer, mincing unit, mincing plates, grating and mincing bowl (also bowl lid), which are seen set out in the illustration.

A new "Standard" Measuring Instrument

A NEW measuring instrument, the 74700-A Maximum Amplitude Measuring Set, recently developed by STANDARD TELECOMMUNICATION LABORATORIES LTD. and produced by STANDARD TELEPHONES AND CABLES LTD., makes interesting news for all who may be concerned with the measurement of transient phenomena. This instrument affords an accurate means of measuring simultaneously both positive and negative peak values of transients, and has a wide range of application.

It is only necessary to present to the instrument transients as voltages within the range 0-10 volts when, provided their peak values persist for at least two milliseconds, the two meters on the set will indicate the maximum positive and negative values with an accuracy of 5%.

Some of the many applications of this new measuring instrument are: determining the firing voltages of gas discharge tubes; peak welding current; voltage surges in capacitors; starting currents in induction motors, and surges in semiconductors.

Whether the applied voltage is uni-directional or of a.c. waveform, the meters will give an accurate record of the maximum positive and/or negative values and will continue to show these readings until manually released. The Maximum Amplitude Measuring Set is a portable instrument weighing only 25 lb. It can be operated directly from any 200-250 volts a.c. mains supply.

NEW LITERATURE

Engineering Design Manual

by S. Parker Smith, C.B.E., D.SC., and *M. G. Say*, PH.D.

IN the second, revised, edition of this book the avowed intention of the authors remains the presentation of an introduction to the physical principles underlying design. Thus no attempt is made to teach practical designing; "juggling with figures" is expressly deprecated. Instead, attention is directed to the laws and properties of electric and magnetic circuits and fields, to the theory of armature windings, and to the analytical and graphical theory of the chief types of electrical machines and their equivalent circuits. To these topics are added a few subjects amenable to graphical treatment—speed/time curves, field plotting, harmonic analysis and transmission line diagrams.

The book is essentially one for reading in connection with a course of lectures or with more general reading on electrical machines, but it should make admirably clear to the student the relationship of many details "lost" in a conventional design study. Published by Chapman and Hall, 259 pages, 7½ in. by 5 in. Second edition, price 16s.

Electrical Installation Work

by T. G. Francis, B.SC., M.I.E.E., M.I.MECH.E.

TWO features mark out this book from most similar works. First comes the close attention given to relevant I.E.E. rules at the appropriate points in the text, and then there is the exceptionally clear description given of some important, if everyday, details of installation technique. Naturally, a description of wiring methods, of testing and of lighting and heating takes up the greater part of the text, but there are useful additional chapters on electrical machines, primary and secondary cells, electric bells, tariffs and power factor correction, and telephones. No particular examination is catered for by the book, but it should prove of value to all electricians and apprentices following a course in electrical installation work. A minor disadvantage at present is that reference is to the 11th edition of the I.E.E. rules (the 12th is current), but this will doubtless be altered in any subsequent edition. Published by Longmans Green, 233 pages, 8½ in. by 5½ in. Price 12s. 6d.

Mapping of Fields

by Ernst Weber

ELECTROMAGNETIC theory has an importance as a basis for electrical engineering design and research which makes it a necessary subject in all appropriate graduate and undergraduate courses. The present work is the first volume of two that will together form "Electromagnetic Fields—Theory and Application," which is planned as a comprehensive study of the subject suitable for post-graduate students. Here static fields are dealt with, and the basic relationships are presented in the first three chapters. The next chapter deals generally with the superposition principle applied to field problems, and then practical experimental, graphical and numerical methods are applied. Finally comes analytical treatment of two- and three-dimensional fields. Published by Chapman and Hall, 590 pages, 8½ in. by 5½ in. Price 80s.

World Railways, 1950-51

Compiled and Edited by H. Sampson

PROBABLY no mechanical device in the world has such a universal attraction as the railway engine, nor is this attraction directed solely to the tractor itself: it extends into the working and operation of railway systems, methods of signalling and into the details of railway administration. For this reason alone, "World Railways" will appeal to a much wider readership than those whose professional interests are concerned with rail transport.

The book is an illustrated survey of railway systems and the locomotives used thereon, throughout the world. Naturally, the major portion is devoted to American railroads, as the United States possesses by far the greatest number of independent systems and the most extensive variety of locomotive designs. Official sources have provided the data, and every care has been taken to ensure that the information is both accurate and up-to-date. The work is profusely illustrated and contains more than 600 pages of text, with 102 maps, 696 photographs and 420 diagrams. For the railway enthusiast this volume is a mine of useful and interesting information. Published by Sampson Low, Marston and Co. Ltd., 25 Gilbert Street, Oxford Street, W.1, 12½ in. by 8½ in. Price 63s.

NEW BOOKS

Transformer Engineering, by L. F. Blume and others. Detailed study of all phases of power transformer performance. Published by Chapman and Hall, 500 pages, 9 in. by 5½ in. Second edition. Price 60s.

Electric Illumination, by J. O. Kraehenbuehl. Principles underlying design of electric lighting for commercial and industrial buildings. Published by Chapman and Hall, 446 pages, 9 in. by 5½ in. Second edition. Price 64s.

Foremanship Training in Technical Colleges. Outlines existing facilities and suggests possible schemes. Published by B.I.M., Management House, 8 Hill Street, London W.1, 36 pages, 9 in. by 6 in. Price 2s. 6d.

Accounting for Management. Training booklet showing importance of accounts to management. Published by T.I. (Group Services) Ltd., Broadwell Road, Oldbury, Birmingham, 23 pages, 9 in. by 6¾ in.

THE WEEK

COMMERCE *in news* INDUSTRY

More Steps to help Defence

A CUT of about 35% in deliveries of machine tools to home civilian consumers is expected in the next 18 months to help the defence programme, announced the Minister of Supply last week. He said regional panels were being established to advise on methods of reducing or deferring the demand for tools. The panels will visit factories in their areas and ascertain how urgent is the need for installing machinery which the firm has on order, but which could be used for defence. They will also suggest redeployment of machinery and alternative methods of production. Each panel will comprise some 25 trade experts.

The Minister also announced the establishment of a Purchasing Commission to encourage procurement in Europe of stores and equipment required for this country's defence programme. It is expected that the Commission's work will help British manufacturing capacity to be used for essential home production and exports to a greater extent than would otherwise be possible. Purchases will be finished and semi-finished goods, including engineering and electrical components. Private firms in this country will also be able to take advantage of the Commission's position in the purchase of goods from the continent. The Commission is to set up offices in Western Germany, Paris, Brussels and Milan. Among the eight members of the Commission will be Mr. W. C. Puckey, director and general manager of Hoover Ltd., and Sir Francis Brake, director of Standard Telephones and Cables Ltd.

Luxuries or Necessities?

FOLLOWING the E.A.W.'s request to the Chancellor of the Exchequer to remove the additional purchase tax on vacuum cleaners and washing machines (see our issue of May 3) we learn that at least one of the Association's branches has this week supported the action and made representations on the subject. The Edinburgh and District branch sent a letter of protest to the S.E. Scotland Electricity Consultative Council in which it explains that the imposition of purchase tax was a wartime measure to check inflation, and although its continuance was arguable so far as luxury goods were concerned, there was no case for such a heavy tax on goods regarded as necessities in every home. The Chancellor increased P.T. on these appliances from 33⅓ to 66⅔% in this year's budget. The question as to whether the appliances were necessities or luxuries caused some division among members, but it was eventually agreed to approach the Board with a request to take the matter up with a higher authority.

Radio Sales remain Steady

SALES of radio and television sets were barely maintained during March, the pre-budget month, according to the latest figures issued by the R.T.R.A. The figures in both instances still show an appreciable increase over the corresponding months last year. The index for April will probably be especially interesting in view of the purchase tax increases made in the Budget. First effects of the alterations will no doubt become apparent and it will not be surprising if some fall in sales is recorded. The average number of sets sold per shop was:—

Month	1951	1950
Radio:		
February	12·75	11·89
March	12·09	10·05
Television:		
February	12·12	7·04
March	12·14	7·32

Electric Offices at Olympia

THE ever-increasing part played by electricity in offices will undoubtedly be realised by visitors to the Business Efficiency Exhibition, one of the largest shows of its kind, which opens at Olympia on June 6. The innumerable developments in office electrification of recent years would fill a book, but introductions at this exhibition include an electronic stencil-making appliance to replace old methods of stencil cutting, and a new series of duplicators operated by a fractional h.p. electric motor suitable for any a.c. or d.c. voltage.

The First Half-Century

Glasgow is fairly simmering with pride at the success of its International Exhibition. Although the show has been open only a fortnight the question as to whether it will be a success or not has already been triumphantly settled. The usual features may be taken for granted—the blaring of bands, the delights of the chute and the sound of squeals of girls on the switchback, the fancy stalls. But Glasgow put Instruction first. The machinery department contained the most comprehensive collection of engineering productions ever brought together in Great Britain. Perhaps the most significant lesson taught by the exhibition as a whole is the all-sufficiency of the electric motor.—*From our issue of May* 16, 1901.

The widest range of electrical equipment will be among the accounting and statistical calculating machines. Other exhibits will include a letter opener to deal with 500 letters a minute, all-electric typewriters, dictaphones, and one of the fastest clock-in-and-out machines.

Large British Installation in Rio

WHAT is believed to be one of the largest fluorescent street-lighting schemes in the world has been completed by the British Thomson-Houston Co. Ltd. at Rio de Janeiro. Some time ago Rio's Tramway, Light and Power Co. invited British, American and French firms to give demonstrations of highway lighting, and it was later decided to let the contract to the British company, which was asked to supply over 300 lanterns and lamps. Since then, however, extensions to the scheme have been authorised and now consists of 662 type SL750 lanterns. These fittings each house three 5ft 80 W fluorescents, although at present only two of the lamps are being used owing to Rio's power shortage.

The main part of the installation is on the Avenida Brasil, a roadway being built as the principal outlet from the city to holiday resorts of Petropolis and Terespolis and to Rio's future industrial area. The remainder of the scheme is in the Avenida Brigadeiro Trampowski, which leads to the new university city and the airport at Galeao.

Power supply is from 6,300 V overhead lines, stepped down to 250 V through transformers, with one transformer for every 20 lanterns. The suspension brackets have been manufactured locally.

British Scientific Instruments

THE Electrical Research Association sent two exhibits to the Paris Exhibition of British Scientific Instruments, now being held at the Palais de la Decouverte. One is a vacuum torsion balance designed for the study of moisture in dielectric materials with low moisture content. The instrument is sensitive to a change of 10-7g in a load of 0·1g, and weighings can be made at minute intervals with the load changing at the rate of 10-6g per minute. The glass beam is suspended by two vertical glass fibres fused directly to the beam, and the loads are supported by two more fibres fused to the ends of the beam. This is considered more robust than the suspension from a torsion fibre.

The second exhibit is a bridge designed for the measurement of admittance of electrical insulation at frequencies between 0·05 and 50 c/s. In order to render it suitable for testing the major insulation of electrical supply systems, it has been designed to be direct-reading in capacitance and conductance, to be easily and quickly balanced, and to be applicable to the testing of specimens with one side solidly earthed. The exhibition closes on Saturday.

War Memorial in Board's Offices

A MEMORIAL plaque has been unveiled at Rhostyllen to commemorate the 25 members of the staff of the former N. Wales Power Co. who gave their lives in the 1939-45 war. The ceremony was performed by Air Commodore C. E. Benson, chairman of the old British Power and Light Corporation, at the offices of No. 4 sub-area of Merseyside and N. Wales Electricity Board, which until 1948 were the headquarters of the old company. On behalf of the former Corporation Air Commodore Benson thanked the chairman and Board for so readily concurring with the suggestion that the memorial should be set up in what were now the offices of the Board.

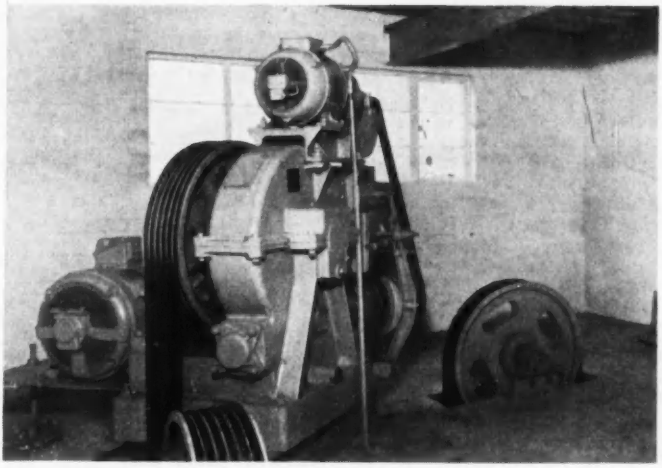
N. Wales Hydro-electric Scheme

AN attractive little brochure featuring the power stations which comprise the North Wales Hydro-electric Scheme has been produced for the Merseyside and North Wales Division of B.E.A. by Garraway Ltd. Opening with a brief explanation of the Electricity Act, the 20-page booklet goes on to give an over-all picture of the scheme and short articles on each of the stations. Numerous illustrations and maps combine to give an excellent summary of power generation in the area.

Private Collier Fleets Threatened

FURTHER criticism of nationalised undertakings' policy of building up their collier fleets was voiced by the head of one of the largest firms in the coal-carrying business last week. In our issue of April 19 we reported similar criticism which

A section of the Avenida Brasil, Rio de Janeiro, where B.T.H. have installed 662 lighting fittings, gaining the contract at the expense of American and French firms. Note that the light output will be increased when all, instead of two of the three lamps, are lit in each fitting. Rio also suffers from electricity shortages



Typical heavy lift machine used for the latest dual capacity goods lift developed by Express Lift Co. Ltd., London

came from a meeting of the North of England Shipowners Association. The latest accusation was that state-bossed gas and electricity boards were threatening to squeeze free enterprise shipowners out of Britain's coastal coal trade by stepping up their own fleets. The result was that a firm which for 50 years had taken coal from Newcastle to gasworks and power stations on the Thames was now planning to branch out into other fields. To what extent the nationalised Boards' policy will be carried out it was impossible to say, commented the speaker, but shipowners could ill afford not to look ahead and find alternative means of trade.

Lifts for Heavy Loads

THE moving of heavy loads from one floor of a factory to another at the greatest possible speed has long been a problem confronting lift manufacturers. Many attempts have been made to design a lift to overcome this difficulty and the Express Lift Co. now appears to have solved the problem with their latest dual-capacity goods lift. This can raise weights of 2 tons at 150 f.p.m. or 5 tons at 50 f.p.m. Normal working is the first of these two rates, and to suit this a weight of 1½ tons is carried under the car in a specially developed release mechanism. To balance the lift for heavier goods the weight is deposited at the bottom of the shaft, the changeover from one capacity being effected from within the car. The system is electrically interlocked.

The lift itself is operated on the Trulevel power system. Two motors are used, a single-speed squirrel-cage motor and a two-speed pole-changer. The former provides full-speed running for loads of 2 tons and the high-speed winding of the pole-changer full-speed running for 5 tons.

Hooting Out Collectors

THE 30-year-old custom of van drivers sounding their horns to call meter readers from houses for collection of money was the subject of a court case at Walsall recently. A van driver employed by the Midlands Electricity Board pleaded not guilty to using his horn while the vehicle was stationary. The driver told the bench that he saw a reader's bicycle outside a house and gave two short blasts as a prearranged signal. He was alleged to have told the police that the practice had been followed for years as it was the only way to get the men out of houses. His job was to collect the meter reader's money.

The magistrate remarked that the majority of people were unaware that it was an offence to sound a hooter while stationary and the case was dismissed. As a result of the police complaint the M.E.B. gave instructions that the custom would be discontinued, and defending counsel pointed out that since the order, accused had missed four men because he had not used the signal. The driver was fined 5s. for failing to produce a certificate of insurance.

Lunchtime Lectures

THE Institute of Export has announced another series of lunchtime lectures arranged for students studying for the institute's own examinations and for those of other professional bodies. The forthcoming series of 18 meetings will take place at the Baltic Exchange, St. Mary Axe, E.C.3, during May, June and July. Lectures will be given on Tuesdays and Thursdays between 1 and 2 p.m., the first being on May 17. Admission will be by ticket only, available from the General Secretary, 140 Cromwell Road, S.W.7.

British Transmitter for Sweden

A FURTHER contribution to Britain's export drive in hard-currency areas was the recent addition to the broadcasting services in Sweden of a medium-wave transmitter at Gothenburg, supplied by Standard Telephones and Cables Ltd. The transmitter has an output of 150 kW with two radiators. To minimise interference, the signal is reduced in the direction of N.W. Africa, where a broadcast transmitter is working on the same frequency.

Built in 1925, the Gothenburg station was one of the first in Sweden, and was equipped with a transmitter of 500 W. In 1928 it became a 10 kW station serving about 400,000 people. The new

150 kW transmitter will serve about 750,000 of the Swedish population. All this equipment was manufactured by the same company.

Threatened for not Striking?

WHEN the hearing was resumed last Thursday in the application concerning eight members of the Electrical Trades Union who sought an injunction restraining minor officers from taking any disciplinary action against them, it was alleged that they had already been threatened because they did not take part in the Bethnal Green strike. Sir David Maxwell Fyfe, applying for a speedy trial, said he understood that there were two occasions on which threats were said to have been uttered, and the position of the plaintiffs was very difficult. One of them had actually been sentenced by his own branch for failing to take part in the strike, he declared. The hearing was adjourned.

I.E.E. Garden Party

ARRANGEMENTS have been made by I.E.E. to hold a Garden Party during the Joint Engineering Conference which is to take place between June 4 and 15. The Party will be at St. John's Lodge, Regent's Park, on the evening of Wednesday, June 6. This function will supersede the Institution Conversazione, last held in 1948, but on this occasion it has been found necessary to make a charge of 12s. 6d. for each ticket. Concerning the Institution's future activities, we have been asked to point out that the recent practice of enclosing notices with the monthly Journal will be continued to save postage and stationary expenses.

Proposals to cope with Power Cuts

SEVERAL suggestions were advanced at last week's meeting of the London Electricity Consultative Council to cope with the ever-present problem of load-shedding. Members expressed grave concern over recent experiences of power cuts in May, and a woman member commented that it was extremely difficult to explain to consumers that the recent permission to use advertisement lighting and floodlights had no bearing on the cuts. The opinion was held generally among consumers that the Festival was largely responsible. The London Board has, however, issued a statement to the lay Press disproving this belief.

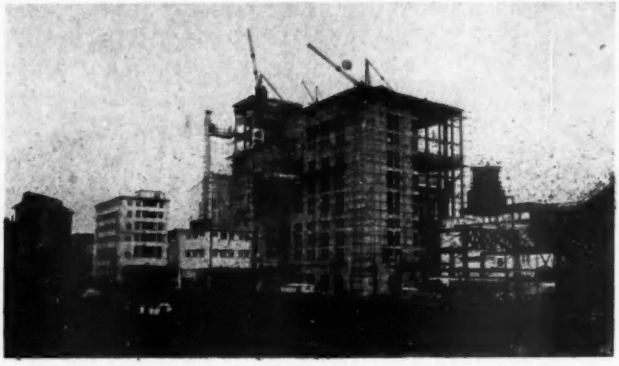
As the question of plant maintenance had a lot to do with present cuts, it was suggested that special maintenance "gangs" be formed to deal solely with the annual overhaul of equipment. This, it was said, would release manufacturers, who usually carried out overhauls on their own equipment, to concentrate on the provision of more plant. It was also proposed that authorities responsible for central heating in large blocks of flats and offices should postpone the date on which they abandoned central heating for the summer. This would save on the use of electric fires. As far as these appliances were concerned, one member proposed that the sale of fires should be stopped. It was pointed out that the Board was not selling fires and was refusing to connect them. Other suggestions included the further staggering of the rota system and that planning of overhaul arrangements be adjusted. All these proposals were forwarded to the Board.

British Firm's venture in Canada

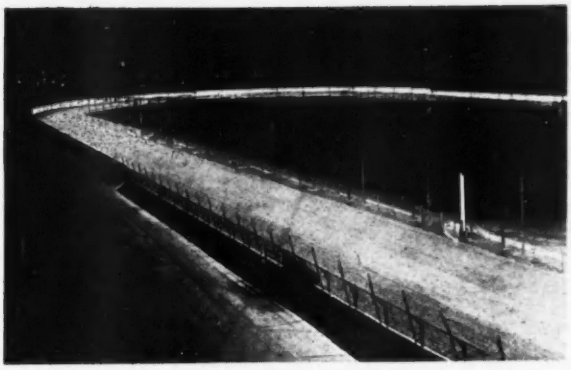
IT WAS announced last week that David Brown and Sons (Huddersfield) Ltd. has established a new company in Canada. The formation of this new enterprise, which will be based on Toronto, is primarily intended to supplement the existing agency coverage of the gear manufacturing group. Initially, the new branch will act as a sales organisation covering Eastern Canada, and representation in the western parts of the country will be handled, as before, by Gordon Russell Ltd. of Vancouver. A. C. Wickman (Canada) Ltd., Toronto, will also continue to handle the company's wide range of gear and spline hobbing machines. The name of the new branch is David Brown (Canada) Ltd.

T.U.C. Plans for next Winter

THE special committee of the National Production Advisory Council on Industry last week



After a slow start, the Pyrmont "B" power station, Sydney, New South Wales, is now rapidly taking shape, as can be seen from our illustration. The ash and dust collection building is to the right of the boiler house. Two 50 MW Metro-Vick, 1,250 p.s.i., 950°F turbo-alternators (which have been in store for some time) and I.C.L. 430 k. lb/hr boilers are being installed. The first unit is expected to be steaming by December, and the second by next July. The major items of the 3rd and 4th boilers and turbines are largely manufactured and in process of being shipped



An excellent view of the winning post and final straight, from the grandstand at Dunmore Park greyhound track, Belfast, provided by Siemens and Benjamin lighting fittings

considered next winter's supplies of electricity. The T.U.C. has been asking for a committee to investigate and report on the fuel situation, and just before Easter it secured the support of the F.B.I. for an approach to the Chancellor of the Exchequer. A recent statement by the T.U.C. said that the various fuel industries, organised as competing services, could not be expected to cope with peak difficulties in mid-winter. The nationalised undertaking might well have some misgivings about the operation of a co-ordinated fuel policy such as the T.U.C. wanted.

The Council also asked if it was wise to create generating capacity sufficient to meet the peak load. The cost of providing the extra units required for comparatively short periods during a small part of the year was excessively high. A co-ordinated policy would make use of other fuels to reduce the peak load. A better delivery service of solid fuel, particularly to households with limited storage space, might considerably reduce the domestic use of electricity for heating.

Going to the Dogs?

VISITORS to the Dunmore Park greyhound track, Belfast, will have a very clear view of events in future, as a result of the new lighting installation carried out by Siemens Electric Lamps and Supplies and the Benjamin Electric Co. The latter have modified their previous dog-track units and the new type, No. 4927, has proved most effective, providing racegoers with an excellent view, as our accompanying illustration shows. Just over 80 of these latest fittings have been utilised in the installation, each of which accommodates a 1,000 W Siemens G.L.S. lamp. Provision has also been made in the arena for speedway, which is to run on the inside of the greyhound track. The lamps have therefore been placed between the two circuits, not only to give light to both tracks, but also to leave the centre clear for riders to swerve into the middle. Contractors in this installation were Messrs. Curron Bros., Belfast.

NEWS IN BRIEF

As from last Monday the export of iron and steel goods under Open General Licence will be allowed only if the value exceeds the value of the iron and steel content calculated at £30 per ton. Previous value was £21 per ton.

Two E.D.A. films have been selected for inclusion in the programme at the Berlin Film Festival on June 16 and 17. They are *Electro-Chemistry*, which won first prize in the scientific section of the Venice Festival last year, and *Fifty Acres*, showing how electricity transformed a small farm.

A contract to manufacture and install four additional Strowger-type telephone exchanges for Iran has been received by the G.E.C. Included in the contract is the laying of a complete underground network, with above ground junction boxes, distribution cables and leaded cables to satellite exchanges.

Questions in Parliament

Aluminium and H.E. Projects

Mr. Dugdale said Aluminium Ltd. of Montreal and the British Aluminium Co. had made a joint examination of alternative projects for establishing aluminium smelters in North Borneo or the Gold Coast. The results were under construction, and further discussion and additional technical investigation in the Gold Coast would be necessary.

Power Cuts

On Thursday last the Minister of Fuel replied to a private notice question from Mr. Geoffrey Lloyd, asking for a statement about recent power cuts. He attributed these to three main causes, the first of these being the great increase in the demand for electricity, with 14% more sent out by the B.E.A. during the first four months of this year than during the corresponding period a year ago. Next came the large proportion of generating capacity—28%—out of commission mainly owing to necessary summer overhaul and maintenance work, and to the temporary breakdown of plant. The third cause was the exceptionally cold weather which had been experienced. It was estimated that in April and May a drop of 1° F in temperature might increase the demand by 100 MW. On the preceeding Monday and Tuesday the maximum temperature at Kew had been 12° F below normal. Dealing with supplementary questions, Mr. Noel-Baker said that unsuitable coal had had only a very small effect on the large outage of plant. The total outage was greater than before

the war, and the amount of breakdown was in particular heavier because of the old plant which had to be retained in service, the new plant which was having heavy teething troubles, and the relatively greater amount of plant which had to be run continuously. He was not aware that the troubles were caused by the installation of novel and untried steam-raising and generating equipment.

Exports to China

During the course of an answer given by Sir Hartley Shawcross, concerning the U.K. trade with china, he stated that in the first three months of 1951, iron and steel and manufactures thereof sent to China amounted to £230,000. Of this, 293 tons of wire cable and rope totalled £34,000, and 1,170 tons of tubes, pipes and fittings valued at £95,000. These tubes, pipes and fittings were largely for use in connection with the repair and maintenance of the Shanghai power station. Electrical goods and apparatus totalled £163,000, of which the principal items were: insulated cables and wires (£64,000); electro-medical apparatus (£30,000), insulating materials (£14,000), house service meters (£12,000), X-ray apparatus (£11,000) and radio and telecommunications equipment (£9,000). Among the machinery to a total value of £225,000 shipped, were boilers and boiler house plant, also destined for Shanghai power station, valued at £91,000, electrical generators without prime movers (£12,000), and portable power tools (£12,000).

Electric Supply News

Eire

Restrictions in the use of electricity were put into operation by the Electricity Supply Board last week, owing to the abnormally high demand on the supply in recent months. Electricity consumed for space heating and water heating is not to exceed half of that in the same period last year. Outside display and shop-window lighting is prohibited, and new connections of heating, water-heating and cooking load suspended.

Kirkwall

The new diesel station of the North of Scotland Hydro Electric Board was formally inaugurated last Tuesday by Mrs. Arthur Woodburn. Initially, its capacity is 3,520 kW, but it is designed for an alternate capacity of 7,000 kW, the largest diesel station for public supply in Britain.

Shetlands

The North of Scotland Hydro-Electric Board recently gave the first electricity supply to the outlying islands of the Shetland group. The island supplied is West Burra, which is one of a group of three islands on the west side of the Shetland mainland. The work involved the laying of two submarine cables to form a connection between the mainland and the islands of Trondra and West Burra. The initial extension will supply approximately 100 homes on the island, including 80 in the fishing village of Hammavoe, but the distribution scheme is to be extended to cover the remainder of the island and the islands of Trondra and East Burra. On the mainland of Shetland, h.t. lines have been erected as far south as Sumburgh Airport, 25 miles from Lerwick, and supplies are being given to Sandwick, 15 miles south of Lerwick. In addition, the Board have placed a contract for a new distribution line to supply the villages of Bixter and Aith, west of Lerwick.

S.W. Scotland

The South West Scotland Electricity Board has approved a scheme to effect an immediate reinforcement of the network in the centre of Glasgow at a cost of £34,000. This will involve the laying of over one mile of underground cable, the provision of new switchgear and the installation of a 6 MVA transformer in the Board's substation at Midland Street, which will then be able to take some of the load from three surrounding substations. It is anticipated that the necessary work will be completed in time for the 1951-52 winter load. The Board is also to spend £84,000 in affording an electricity supply to several new housing schemes in the area.

Wales

Strong dissatisfaction over the slow progress being made in extending electricity supplies to rural areas in Wales was expressed at a recent conference held under the auspices of the National Farmers' Union. It was decided to urge union headquarters to take action to obtain a larger financial allocation for the electricity boards in Wales this year, and to ensure that a large proportion of that allocation be utilised for rural developments.

LIGHTING SCHEMES

Bromley (Kent).—The borough engineer is to prepare a scheme for the general improvement of street lighting in the Borough.

Chaddesden (Derbyshire).—The Parish Council is to raise a loan of £6,500 for the extension and modernisation of its street lighting system.

Lanarkshire.—The C.C. has approved a priority programme for new street lighting in 10 county areas at a cost of £91,000. The districts are Bargeddie, Bothwell, Blantyre, Calderbank, Cambuslang, Chapelhall, Cleland and Omoa, Lesmahagow, Salsburgh, and Uddingston.

London Colney (Herts).—The Council is to carry out a scheme to improve street lighting, at a cost of £2,018.

Middleton.—A scheme is to be prepared for the improvement of side-street and back-street lighting in the borough.

Rotherham.—Application is being made for consent to borrow £2,594 for street lighting on the Kimberworth housing estate.

Company Activities

Automatic Telephone and Electric Co.

Group net profit for 1950 increased by £173,259 to £714,268, after providing £812,421 (*£651,890*) for U.K. and overseas taxation. There is a further Ordinary dividend of 12%, making 15% for the year. There is £49,172 placed to general capital reserve, £57,637 (*£171,873*) to general reserve, £255,000 (*£175,000*) to stock reserve, £77,206 (*£47,999*) to scientific research, £100,000 to the provident fund. Dividends absorb £137,550 (*£117,992*), and there is £341,512 (*£304,207*) carried forward.

Babcock and Wilcox Ltd.

Consolidated trading profit for 1950, at £4,310,856, is an increase of £2,154,062 over the corresponding figure for 1949. Depreciation takes £732,628 (*£432,282*), and directors' emoluments £777,433 (*£474,558*), and investment income of £52,839 (*£117,729*) is added. U.K. taxation absorbs £2,820,628 (*£1,203,582*), leaving a net profit of £1,543,067 (*£1,070,941*), of which £1,530,343 (*£1,066,505*) is attributable to Babcock and Wilcox Ltd. Adding provisions from previous years no longer required £96,936 (*nil*), and sundry capital profits £11,768 (*£115,993*), consolidated net profit attributable to the parent company is £1,639,047 (*£1,182,498*). There is a final Ordinary dividend of 10%, making 15% for the year, plus bonus 3%. £150,000 is placed to research and development reserve, and £650,000 to the general reserve, leaving a balance of £203,699. The chairman, Mr. W. Lionel Fraser, attributes the rise in trading profit to the unprecedented increase in output. He says the average annual rise in turnover since the war has varied between 12½% and 15%, but for 1950 the increase over the previous year was 40%.

Barton and Son Ltd.

Consolidated net profit for 1950, after taxation, is £164,578 (*£118,509*). There is a final Ordinary dividend of 8½% (*7%*), making 12½% (*10%*) for the year. The sum of £80,000 (*£70,000*) is placed to reserve.

Ever Ready Co. (Gt. Britain) Ltd.

Group profit for the year ended February 28 last is £837,456, as against £687,106 for the previous twelve months. Directors' and auditors' emoluments absorb £61,861 (*£76,461*), depreciation takes £80,000 (*same*), and taxation £362,083 (*£219,836*), leaving a net profit of £333,512 (*£310,809*). With £119,720 (*£118,414*) brought in, there is £453,232 (*£429,223*) available. The sum of £108,705 (*£90,000*) is placed to revenue reserve, £14,000 (*same*) to benevolent fund, and, after payment of dividends, there is £130,327 carried forward. Mr. E. N. Rowbotham, the chairman, points out that both sales and net profit thus constituted records in the firm's jubilee year.

Enfield Cables Ltd.

The group profit, after allowing for all charges, but before tax, is £381,941 (*£456,504*). To taxation £210,536 (*£267,704*). The final Ordinary dividend is 3¾%, making 7½% (*same*).

Laurence, Scott and Electromotors Ltd.

For 1950 the trading profit amounts to £431,313, compared with £381,269 for 1949. After allowing charges for depreciation and management, £17,504 (*£15,000*) to pension fund, and £209,000 (*£162,500*) for taxation, the net profit is £134,063 (*£134,403*). The sum of £40,000 (*nil*) is placed to general reserve, and £25,000 (*£40,000*) to contingencies reserve. Although confident of the future, the Board feels that it would be reckless to discount the difficulties that can arise through the onset of inflation and shortages of raw materials. They therefore do not recommend the restoration of the Ordinary dividend to the pre-war level of 15%, but propose it should be the same as last year—12½%. Additional factory space, comprising about six acres of land and buildings of 72,000 sq ft, has been acquired in Salhouse Road, three miles from the main works.

Parnall (Yate) Ltd.

By some inexplicable slip, incorrect data was given in our May 3 issue regarding this firm who are well known as manufacturers of various types of cooking and water heating equipment, washing machines, etc. The year ended December 31 last resulted in a group net profit of £77,112 (compared with £80,202 in the previous year), after charging depreciation, directors' emoluments, taxation, etc., and after providing for all development expenditure associated with new products. Taxation charged amounts to £19,000 (*£11,500*). Tax provisions not now required £29,016 (*£50,000*). The Ordinary dividend is increased by 1% to 6%, absorbing £23,625 (*£20,625*), the balance carried forward being £120,270 (*£68,012*). The Earl of Limerick, chairman, states that in regard to Parnall (Yate) Ltd., the turnover of the parent company increased in 1950 by some 50% compared with 1949. So far, in 1951 the turnover has shown further expansion. It is yet too early to define the effect the doubling of p.t. on washing machines will have on the sales of those goods.

National Electric Construction Co.

Profit for 1950, after allowing for all charges, including taxation, is £42,984 (*£45,979*). U.K. taxation takes £37,849 (*£38,450*), and the 10% dividend absorbs £9,713 (*£10,175*).

Dividends Declared

London Electric Wire Co. and Smiths.—Final Ordinary dividend 6%, making 10% (*same but on a smaller capital*). Net profit £346,836 (*£400,136*).

Harland Engineering Co.—Ordinary dividend 9% (7%). Group net profit £74,267 (*£51,113*).

Newman Industries.—Ordinary dividend 6% (*10%*). Net profit £3,994 (*£20,855*).

Worthington-Simpson.—Final dividend 10%, making 20% (*same on smaller capital*).

Commercial Information

CONTRACTS OPEN

HOME

May 18.—Ashton-in-Makerfield U.D.C. Supply and erection of 100 concrete columns and 100 lanterns, lamps, auxiliary gear and wiring for Class A street lighting on trunk road A.49. Surveyor, Town Hall.

May 18.—St. Albans (Herts) R.D.C. Provision and installation of 31 sodium vapour lighting units in High St., Redbourn, including supply and erection of concrete columns, lanterns, auxiliary equipment and wiring. Surveyor, C. Huskinson, 43 Upper Lattimore Rd., St. Albans.

May 18.—S. Liverpool. Installation of bed lights at home for invalid women, 96 Upper Parliament St., Liverpool 8. Garnet Chaplin, secretary, S. Liverpool Hospital Management Committee, Sefton General Hospital, Liverpool 15.

May 19.—Slough T.C. Supply, erection and installation of 61 concrete columns, lanterns, 80 W mercury vapour lamps and equipment in Group B. Borough Engineer, Town Hall. Deposit £2 2s.

May 19.—Southwick U.D.C. Installation of street lighting on Ridgeway housing estate. Engineer and Surveyor, Town Hall, Southwick, Sussex. Deposit £2 2s.

May 20.—Grantown-on-Spey T.C. Electrical work in construction of five double blocks of houses. Applications by above date to A. Cattanach, Architect, Kingussie.

May 21.—Ballymena. Rewiring of and additions to electrical installation in Ballymena Cottage Hospital, and alterations and rectifications at Gate Lodge for N.I. Hospitals Authority. Secretary, Ballymena Cottage Hospital.

May 21.—Coseley U.D.C. Supply and erection 35 250 W mercury vapour lighting units and concrete columns on Birmingham-Wolverhampton road. J. C. Roper, Clerk of the Council, Council House. Deposit £2 2s.

May 21.—Cuckfield U.D.C. Installation of electric lighting and power circuits in 74 houses at Haywards Heath and Cuckfield. Housing Manager, Council Offices, "Maxwelton," Boltro Rd., Haywards Heath.

May 21.—N. Ireland. Electrical installation in 45 houses at Broughs Lane for N.I. Housing Trust. Offices of Trust are at 12 Hope St., Belfast. Deposit 10s.

May 21.—Southport T.C. Electrical work at 69 Albert Rd. Borough Architect and Town Planning Officer, Pavilion Buildings, Lord Street.

May 22.—Leslie T.C. Electrical work in erection of 32 houses on Prinlaws site. Applications to A. D. Haxton and Watson, Architects, Leven.

May 23.—Southport T.C. Supply and installation of electric lighting and power points in Transport Offices, 1 Eastbank St. General Manager, Town Hall.

May 24.—Longbenton U.D.C. Electrical installations in dwellings under the following four contracts: 48 houses at Forest Hall; 23 houses on Fordley Estate; 14 old persons' homes and recreation room at Burradon; and 7 houses at Forest Hall. R. E. Sweetman, Engineer and Surveyor, Council Offices, Forest Hall, Newcastle-on-Tyne. Deposit £2 2s.

May 24.—Manchester. Supply of electric lamps to Baguley Hospital, Christie Hospital, Hold Radium Institute, Withington Hospital and Devonshire Royal Hospital, required by South Manchester Management Committee. Supplies Officer, Withington Hospital, Manchester 20.

May 25.—Belfast. Supply and erection of 33 kV 1,500 MVA open type indoor switchgear of the airblast or small oil volume type. Merz and McLellan, Carliol House, Newcastle-on-Tyne 1. Deposit £5 5s. (See April 12 issue.)

May 25.—Belfast. Supply and erection of carbon dioxide fire extinguishing equipment for electrical substations. Also of 6,600 V compound filled armour clad switchgear of 250 MVA capacity, during period from July 1 to March 31, 1952. Electricity Dept., East Bridge St. Deposit in respect of first mentioned, £2 2s. (See May 3 issue).

May 25.—Sheffield. Electrical installation at Totley Hall College for housecraft. W. G. Davies, City Architect, Town Hall, Sheffield 1. Deposit £2.

May 26.—Swansea T.C. Electrical installation in 44 houses at Penlan. Applications by above date to Borough Architect, The Guildhall. Deposit £2 2s. (See May 3 issue.)

May 28.—Bedford T.C. Provision and erection of 120 3/80 W fluorescent lamps, control gear and columns for lighting sundry roads in borough. C. H. Blakeway, Borough Engineer and Surveyor, Newnham House, Horne Lane.

May 28.—Metropolitan Water Board. Supply and erection of two self-cleansing electrically driven rotary screens at Chingford (Essex) pumping station. Chief Engineer to Board, New River Head, Rosebery Av., E.C.1. Deposit £1 1s.

May 28.—Sowerby Bridge U.D.C. Supply and erection of 58 street lighting columns, lanterns, cut-outs, etc. Alfred Womersley, Clerk of the Council, 23 Wharf St. Deposit £2 2s. (See May 10 issue.)

May 28.—Staines U.D.C. Installation of electricity in 94 houses on Worple Ave. estate. Work includes wiring, lighting points, switches, 5 and 15 amps points. Engineer and Surveyor, Shortwood House, 240 London Rd. Deposit £2 2s. (See May 10 issue.)

May 29.—Belfast. Supply of electrically illuminated traffic signs. Executive Officers' Dept., Police Committee, 84 Chichester St., Belfast.

May 30.—Banstead (Surrey) U.D.C. Erection only of approximately 496 concrete lamp columns, and supply and fixing of 496 lanterns with auxiliary equipment and other incidental works under Class B street lighting. Council's Engineer and Surveyor, Council House, Brighton Rd. Deposit £2 2s.

May 30.—Cork. Supply and installation of vehicle-actuated traffic signals at junctions of Grand Parade and Washington St., Main St. and Washington St., and Langford Row and Infirmary Rd. Tenders to P. Monahan, City Manager and Town Clerk, City Hall.

May 30.—Northampton R.D.C. Electrical installation in 96 houses now being built. R. J. Miller, architect, 1 Cheyne Walk.

June 2.—Haslingden T.C. Electrical work in erection of 4 houses and 20 flats in Church St., and a block of 8 flats in Bury Rd. James Mason, Borough Engineer and Surveyor, Municipal Offices. Deposit £2 2s.

June 4.—Durham. Supply of sundry laboratory and workshop machinery and equipment for Stockton-on-Tees technical college, including electrical engineering motors, generators, transformers and instruments, electricians' tools and equipment. Applications to A. A. Denholm, Director of Education, Shire Hall, Durham.

June 4.—Dorking (Surrey) R.D.C. Electrical work to 3 arches under Station Approach, Horley. Surveyor, Russelldene, Church Rd., Horley.

June 9.—Leeds. Manufacture, supply and erection of following equipment for pumping station at Knostrop sewage works: one 6·6 kV, 400 A, 150 MVA switchboard; one 2 kV, 400 A, 50 MVA switchboard; one ·415/·346 kV, 2,000 A, 25 MVA switchboard; two 1,000 kVA, 6·6/2·0 kV transformers and two 500 kVA, 6·6/·415/·346 kVA transformers. Sewerage Engineer's Office, Civic Hall, Leeds 1. Deposit £5.

June 11.—Worthing T.C. Rewiring of electric circuits in approximately 130 houses on S. Farm estate. Borough Engineer and Surveyor, Town Hall. Deposit £3 3s.

June 15.—Oswestry T.C. Provision, erection and wiring of 29 concrete columns, 12 varied brackets and one central suspension fitting, with 42 lanterns and H.P.M.V. lamp, gear, time-switches, etc., on Swansea-Manchester trunk road. Borough Surveyor, Guildhall. (Advertised in this issue.)

June 16.—St. Neots U.D.C. Supply and erection of 26 concrete columns, one wall-mounting bracket, 27 lanterns with 140 W sodium lamps, auxiliary equipment and wiring for street lighting on Ipswich-Weedon trunk road A45. L. Henderson, clerk of the council, Council Offices, Huntingdon St., St. Neots, Hunts. Deposit £2 2s. (See May 10 issue.)

June 18.—Fleet (Hants) U.D.C. Supply of two sets of electrically driven vertical pumps with ancillary equipment, capable of pumping 300 g.p.m. Engineers, John Taylor and Sons, Artillery House, Westminster, S.W.1. Deposit £5.

June 25.—Coventry. Electrical installation at Whitley Abbey E.S.N. school. Applications to W. L. Chinn, Director of Education, Education Offices, The Council House, Coventry, by May 31. Deposit £2 2s.

June 26.—Galway. Electrical installation in new regional general hospital at Galway. Work covers mains and switchgear, lighting, service plugs, etc. Consulting engineers, J. A. Kenny and Partners, 44 Kildare St., Dublin C.17. Deposit £26 5s.

No date stated—Bristol.—Stapleton Hospital Management Committee invites tenders for supply of electric lamps and sundry electrical materials for year ending March 31, 1952. Applications to be placed on list of suppliers should be submitted to D. Pearson, secretary of Committee, 200 Manor Rd., Fishponds, Bristol.

No date stated.—Tranent. Electrical work in erection of 3 shops and 2 houses at Coalgate Park. Names should be submitted to Town Clerk, Tranent.

No date stated.—Fort William. Electrical installation in erection of six blocks (total of 26) houses on Claggan site. John A. W. Grant, chartered architects, 36 Melville St., Edinburgh.

No date stated.—Markinch T.C. Electrical work in 32 houses on Sweetbank site. Applications to A. D. Haxton and Watson, architects, Leven.

OVERSEAS

*Details of items marked * may be obtained on application to Room 1076, Board of Trade, Thames House, North Millbank, S.W.1, quoting reference.*

May 31.—Sydney. Manufacture, testing, supply and delivery of relays and associated equipment for 33 kV busbar protection at Blacktown substation. B.o.T. (Ref. CRE (IB) 60206/51)*

May 31.—Wellington (N.Z.). The N.Z. Post Office, Stores Division, G.P.O., Wellington, invite tenders under contracts No. P and T 150/4349, for supply and delivery of 400 miles of tinned copper wire.

June—Egypt. Supply of 87,000 metres of cable and 250,000 metres of copper wire, closing date 9th; cupholders, insulators and spindles, 12th; 2,783,000 cadmium sleeves jointing, 14th; telegraph material for army, 19th; telephone and telegraph materials, 25th; and 45,000

Your Queries — Answered

"Savage" transformers, makers of? T.E.—W. Bryan Savage Ltd., Westmoreland Rd., Hendon, N.W.9. (20206)

"Malroy" water heaters, makers of? E.B.—Malroy Heating Co., Ltd., 20 Inglis Rd., Croydon. (20214)

"Omalite" desk lamps, suppliers of? W.P.—Office Machinery Ltd., 3 Vere St., London W.1. (20222)

"Osgaret" hairdryers, makers of? S.E.—Osborne Garrett and Co., Ltd., 51 Frith St., London W.1. (20256)

Welder to operate from car battery, suppliers of? W.W.—Miller and Enfield Ltd., 52 Wardour St., London W.1. (20237)

May-Vale Electrical Mfg. Co., Ltd., address of? S.E.—May-Vale Works, Southsea Ave., Leigh-on-Sea. (20246)

"Phoenix" coffee brewers, makers of? E.B.—S.L.R. Electric Ltd., 58 South Harrow Viaduct, South Harrow. (20229)

The above are selected from questions we have answered this week. If you have a query, send it to us.

magneto desk sets, 26th. All required by Egyptian State Railways and Telegraph and Telephone Administration. Further information from Chief Inspecting Engineer's Office, Egyptian Govt., 41 Tothill Street, London S.W.1.

June 14.—S. Africa. Supply of radio beacon equipment including transmitter units, control unit, motor alternators for S. African Railways. Chairman of Tender Board, P.O. Box 7784, Iohannesburg. B.o.T. (Ref. CRE (IB) 59848/51).*

June 19.—Brisbane. Three 100 kW hydro-electric generating units with switchgear and control equipment for Australian Works and Housing Dept.'s project on Ronana Falls, nr. Port Moresby. Power to be transmitted at 33 kV to existing diesel power house and distributed to Port Moresby 25 miles away.

June 27.—S. Africa. Municipality of Bloemfontein requires (a) 4 miles of 2 pr. 4 core P.V.C. insulated and sheathed pilot cable; (b) 2,000 yd of 3 pr. 6 core P.V.C. insulated, lead alloy covered P.V.C. sheathed pilot cable; or 4,000 yd 3 pr 6 core pilot cable as (b). Town Clerk, P.O. Box 288, Bloemfontein.

July 12.—Sydney. Manufacture, testing, supply and delivery of one 66 kV arc suppression coil for Carlingford substation. B.o.T. (Ref. CRE (IB) 60207/51)*

Oct. 25.—Pretoria. Tenders are invited for 5 (electric) locomotives under contract No. B 2808, by S. African Railways.

No date stated.—Syria. Tender invited by Damascus Electricity and Tramway Co. for construction of a hydro-electric power station and equipment of 7,000 kW on River Barada. Offers as soon as possible. B.O.T. (Ref. CRE(1B) 60540/51)*.

CONTRACTS PLACED

Dagenham. Supply and erection of street lighting equipment for stage 3 of major roads conversion scheme, Eastern Electricity Board, £10,379.

Durham. Electrical installation at Lambton Castle residential college, North of England Engineering and Electrical Co. Ltd., £2,692. Also provision of service cables, joints, time switches, and erection of lighting standards on Birtley by-pass, N.E. Electricity Board, £3,499.

PRICES OF CABLE METALS AND OTHER MATERIALS
(at Tuesday night)

	£ s. d.	New York price
COPPER, electrolytic	210 0 0	£196 0 0
LEAD, good soft pig (foreign)	160 0 0	136 0 0
„ „ „ "English" quality	161 10 0	
TIN (99-99.75%) (Cash)	1125-1130	—
„ (3 months)	1105-1110	—
ALUMINIUM, commercial purity (del.) ...	124 0 0	—
ZINC	160 0 0	140 0 0
ARMOURING:		
Galv. Steel Wire (0.104 in.)	47 10 0	—
Mild Steel Tape (0.04 in.)	26 10 0	—

TRADE NOTES

Change of Address. The Newcastle-upon-Tyne district office of the British Thomson-Houston Co., Ltd., has moved to 9 Higham Place, but the telephone number remains, Newcastle 25040.

Distributors. A.C.E.C. inform us that the Trevor Johnstone Co., Ltd., of 169-174 Sloane Street, Knightsbridge, London S.W.1, have been appointed as their exclusive distributors in England and Wales for the Dictorel dictating machines, with fully competent after-sales service.

Annual Holidays. The various works of British Insulated Callender's Cables Ltd. are to be closed for two weeks. The periods are: July 27 to August 11 for the Prescot, Helsby, Huyton Quarry and Melling Works; July 28 to August 11 for Willenhall Foundry; July 7 to July 21 for Erith Works, Belvedere, and July 7 to July 14 and September 8 to September 15 for Anchor Works, Leigh. In regard to the last period, a skeleton staff will be on duty to deal with customers' urgent requirements.

Clarification. Howard Clayton-Wright Ltd., of Wellesbourne, Warwickshire, ask us to make it clear that that company and its associated companies are not in any way associated with any concern making similar products, and, in particular, flexible bearings.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Electrical and Sound Services Ltd. Resolution for voluntary winding-up passed at meeting on May 1, and Philip W. Hart, 28 Baldwin St., Bristol, and A. Hawes Richards, 39-40 Fleet St., Torquay, were appointed liquidators.

Charles Amplifiers Ltd. Meeting of creditors to be held tomorrow (Friday) at 40 Kensal Rd., W.10, at 2.30 p.m.

Climax Radio Electric Ltd. Meeting of members will take place at 90 Edgbaston Rd., Smethwick, Staffs, on June 11 at 11 a.m., to receive liquidator's report.

BANKRUPTCY ACTS

Order on Application for Discharge

Barrow-in-Furness and Ulverston. Samuel Gordon Penrith, electrical contractor trading at 5 and 14 Mount Pleasant, Barrow-in-Furness. Immediate discharge on condition debtor consents to judgment for £100 payable by instalments of £5 per month. Date of Order, April 11.

Intended Dividends

Birmingham. Albert Wm. Harber, electrician trading at 1 Kathleen Place, Redditch, Worcs. Last day for receiving proofs, May 23. Trustee is R. K. Clark, Official Receiver, Somerset House, 37 Temple St., Birmingham.

Following amended notice has been substituted for that published in *London Gazette* on April 17:—

Leslie Bloom, trading in partnership as "Bloom Bros.", electrical engineers, at 12 Duke St., St. James's, London. First and final dividends of 2s. 6¾d. in £ payable on May 23 at Bankruptcy Buildings, W.C.2.

In regard to our notice concerning the winding-up of New Era Domestic Products Ltd. (see March 10 issue) we have been asked to point out that the firm is in no way connected with New Era Industries (Tottenham) Ltd.

BUSINESS PROSPECTS

HOME

Ashington (Northumberland) U.D.C. Tenders to be invited in near future for electrical installation in 25 bungalows at Blyth Terrace. Surveyor is M. Jamieson.

Belfast. Erection of gymnasium block at Graymount intermediate school, Gray's Lane. Education Architect's Department, Academy St., Belfast.

Billingham-on-Tees. Thomas Swan and Co. Ltd., Rugeley, Staffs, propose to build a light chemical factory. Also Imperial Chemical Industries Ltd. are to extend nylon factory and build maintenance building.

Bognor Regis U.D.C. Erection of 26 houses on Middleton Rd. site. Engineer and Surveyor, Town Hall.

Bradford. Erection of two new wings at the technical college and also of new infants' schools at Reevy Hill and Canterbury Ave. City Architect, Town Hall.

Brighton T.C. Erection of 86 dwellings on the North Brighton estate. Borough Engineer and Surveyor, 26-30 King's Rd.

Castle Ward (Northumberland) R.D.C. It is proposed to build a public hall at Hazlerigg.

Coalville (Leics) U.D.C. Erection of 80 houses on Greenhill estate. R. H. Smith, Engineer and Surveyor, Municipal Offices.

Chester-le-Street (Durham). N.C.B. is to extend offices at Beamish and erect building at Harraton Colliery.

Cumberland. Erection of grammar school at Workington. Names to John H. Haughan, County Architect, The Courts, Carlisle.

Dagenham. Erection of 46 houses on Woodlands estate. Borough Engineer, Civic Centre.

Derby T.C. Construction of 20 houses and 40 flats in Louvain Rd. Applications to Borough Architect, The Council House, Corporation Street.

Devon. Building of children's home at Westmead and new classrooms at Kingsbridge grammar school. H. V. de Courcy Hague, country architect, 97 Heavitree Rd., Exeter.

Eastbourne T.C. Among schemes for which tenders being invited are erection of 24 flats on Chatfield estate, erection of cafe at Hampden Park, and conversion of "Thornwick" into children's home. Borough Engineer, 2/4 Saffrons Road.

Ellesmere (Salop) U.D.C. Construction of 36 houses on Oswestry Rd. site. W. H. Davis, Council's Surveyor, 2 Willow St., Ellesmere.

Eston U.D.C. Erection of 28 houses and 12 bungalows on Grangetown estate. Council's Surveyor is N. C. Harrison.

Also Council is planning erection of shops on Teesville estate.

Glamorgan. Construction of primary school at Port Talbot. County Architect, L. R. Gower, Glamorgan County Hall, Cardiff.

Glendale R.D.C. Tenders expected to be invited shortly for erection of 70 houses on High Fair site. Plans by Reavell and Cahill, Lloyds Bank Chambers, Alnwick.

Gloucestershire. Construction of first stage of new buildings at Technical College, Cheltenham. County Architect, Shire Hall, Gloucester.

Heckmondwike U.D.C. Tenders invited for all trades concerned in building 18 houses on Dale Lane estate. Council's Surveyor, J. K. Garlick, Council Offices.

Hedon T.C. Construction of 34 houses on Westlands estate, New Rd. Architects, Roper, Spencer and Hall, Suffolk Chambers, Scale Lane, Hull.

Ipswich T.C. Erection of classrooms and assembly hall at Sidegate Lane primary school. Architects are Johns and Slater, 32 Foundation St., Ipswich.

Ilkley U.D.C. Construction of 10 houses and 4 flats at Menston. A. Skinner, Surveyor, Chantry Drive, Ilkley.

Kildare (Eire). Building of vocational schools at Kilcock and Rathangan. Robinson, Keefe and Devane, of 22 Lower Baggot St., Dublin, are architects.

Leeds. Erection of a total of 216 houses and flats at Beechwood, North Parkway, Tinshill Swinnow Lane and Gipton, under ten contracts. R. A. H. Livett, City Architect, Priestley House, Quarry Hill, Leeds 9.

Littleborough U.D.C. Erection of 38 houses on Calderbrook Rd. site. G. F. Wild, Engineer and Surveyor, Council Offices.

Middlesbrough T.C. Erection of 68 houses on Berwick Hills estate, in groups of 28, 24 and 16. Apply to Borough Engineer and Surveyor.

Morpeth R.D.C. Construction of 20 houses on Hadstone estate. Council's Engineer and Surveyor, Dacre Street.

North Riding. Contract to be let shortly for rewiring for light and power in County Hall, Northallerton. Plans by County Architect at Northallerton.

Northumberland. County modern school is to be built at Prudhoe this year, at cost of over £141,000. It is proposed to erect Newburn Secondary modern school. Also £6,600 is to be spent on new buildings at Thomas Taylor Homes.

Ormskirk U.D.C. Erection of 40 houses on the Scott estate. E. J. Wright, Surveyor, Council Offices, Burcough Street.

Peterlee (Durham). Alexandre Ltd. are to build factory premises.

Plymouth. Erection of 12 flats and 9 maisonettes in Durnford St. H. J. W. Stirling, City Architect, Seymour Road.

Runcorn R.D.C. Construction of 24 houses in Greenfields Ave., 20 on Bridge Lane estate, Frodsham, and 10 on Chester Rd. site, Helsby. Engineer and Surveyor's Dept., Castle Park, Frodsham, via Warrington.

Southwick U.D.C. Erection of 32 houses on the Ridgeway extension site. Engineer and Surveyor, Town Hall.

Staines (Middx.) U.D.C. Building of 80 maisonettes in Kingston Rd., Laleham. Engineer and Surveyor's Office, 240 London Road.

Stanley (Durham) U.D.C. The New Kye Miners' Hostel is to be converted into 71 dwellings. Council is to build 100 houses for miners at Beamish Mary Colliery.

Sunderland T.C. Sanction has been received to build 200 houses to rehouse persons involved in the demolition of the same number to make way for Wm. Doxford and Sons factory extension. Borough Architect is H. C. Bishop, Grange House, Stockton Road.

Swanage (Dorset) U.D.C. Erection of a total of 50 houses at Herston. Names to W. A. F. Bale, Clerk, Town Hall.

Thirsk R.D.C. Erection of 11 houses at Sowerby. Needham, Thorp and White, architects, 6 High Petergate, Yorks.

Tynemouth. It is proposed to build a new school on Marden estate and a new hall at the Priory school.

Whitehaven T.C. First stage in erection of public halls, restaurant and museum in Lowther St Applications to W. H. J. Browne, Town Clerk, Town Hall.

Whittlesley (Ely) U.D.C. Erection of 16 flats in 4 blocks. Architects, Ruddle and Wilkinson, Long Causeway, Peterborough.

OVERSEAS

India. The Calcutta Mica Corporation Ltd. is interested in contacting mica importers and would like to appoint agents in the U.K. who can market their products. The firm is at 161 Muktarum Babu St., Calcutta 7. Also Messrs. National Electrical Industries, The Industrial Estate, Nr. Tram Terminus, Lallbag, Bombay 12, want to obtain supplies of laminated bakelite sheets in various thicknesses.

NEW COMPANIES

Extracted from the Register issued by Jordans and Sons, Ltd., 116 Chancery Lane, London W.C.2.

Public Company

Electra Finance Co. Ltd., Electra House, Victoria Embankment, W.C.2. To acquire shares, stocks, funds, securities, etc. Cap.: £500,000. Dirs.: Sir E. Wilshaw, Rt. Hon. Lord Pender and C. E. Tavener.

Ashworth Construction Co. Ltd., 560 Coventry Rd., Small Heath, Birmingham. Public works contractors, cable layers, builders, etc. Cap.: £1,000. W. Ashworth signs as director.

Burnham and Co. (Onyx) Ltd., Kangley Bridge Rd., Lower Sydenham, S.E.26. Sign makers and writers, advertising specialists, etc. Cap.: £30,000. Dirs.: F. Y. Burnham, S. H. Burnham and G. P. Burnham.

Cable and Switchgear (Farnley) Installation Ltd., 35 Hare Park Mount, Farnley, Leeds. Cap.: £1,000. Dirs.: W. J. Webb and Charlotte E. Fullstone.

Electric Service and Assembly Ltd., adjoining Northfield Cinema Car Park, Bristol Rd. South, Birmingham 31. Electrical Engineers and Contractors, etc. Cap.: £500. Dirs.: W. White, F. Woodward and E. H. Ricketts.

Excelite Ltd., 2 Westbury Rd., Harlesden, N.W.10. Manufacturers of and dealers in motor car and electric light bulbs, electric and gas lamps, etc. Cap.: £1,000. Dirs.: H. G. Shephard and S. J. Shephard.

Farner Ltd., Bush Lane House, Cannon St., E.C.4. Manufacturers of and dealers in refrigerators, refrigerating machinery, etc. Cap.: £10,000. Dirs.: E. W. Watts and D. L. Taylor.

Lloyds (Port Talbot) Ltd., 121 Station Road, Port Talbot. Dealers in and manufacturers and repairers of electrical fittings, etc. Cap.: £500. Dirs.: H. M. Lloyd, Ethel Lloyd, H. C. Lloyd and R. C. Lloyd.

A. V. Milton and Co. Ltd. Electrical engineers and contractors, etc. Cap.: £10,000. Dirs.: A. V. Milton and Mrs. E. M. Milton, 12 Bevington Hill, Liverpool 3.

S. I. Ryland Ltd., 60 Lincoln Rd., Peterborough. To take over business of an electrical and refrigeration engineer carried on at 25 Cavendish St., Peterborough, by S. I. Ryland. Cap.: £1,000. Dirs.: S. I. Ryland and Mrs. H. A. Ryland.

Speedy and Eynon (Electrical) Ltd., 1 Gas St., Birmingham 1. Electrical and mechanical engineers, contractors, etc. Cap.: £100. Dirs.: G. W. Bannister-Scriven and Marguarite B. Scriven.

Stedman Electrics Ltd., 79 Eccleston Sq., S.W.1. Manufacturers and repairers of electrical and other machinery and apparatus, etc. Cap.: £1,000. Dirs.: P. W. S. Bulman and P. G. Child.

Thompson and Stammers (Dunmow) Ltd., Chelmsford Rd., Dunmow, Essex. Agricultural, general and electrical engineers, etc. Cap.: £40,000. Dirs.: E. P. Thompson, R. R. Stammers and C. R. Hockley.

Warner and Illsley Ltd., Granby Chmbrs., 1 Halford St., Leicester. General, constructional, mechanical, agricultural, motor and electrical engineers, etc. Cap.: £2,500. Dirs.: F. A. Warner and J. E. Illsley.

Waveforms Ltd., 26 Oakleigh Rd. South, N.11. Manufacturers of and dealers in radio, television, electronic and electrical apparatus and equipment, etc. Cap.: £10,000. Dirs.: L. I. Freedman and Mrs. W. L. Freedman.

W. Westover and Co., Ltd., Ultra Works, River Rd., Barking, Essex. Electrical and general engineers. Cap.: £20,000. Dirs.: W. Westover, Mrs. E. L. Westover and W. Westover, jr.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Budgetlite. 695,911. Class 11. Fluorescent lighting fittings. Ainsworth Lighting Inc., 3810, Twenty-ninth St., Long Island City, N.Y.

Mondolite. 695,624. Class 11. Lighting fittings. Troughton and Young (Lighting) Ltd., 143 Knightsbridge, S.W.1.

Simphonic. 689,518. Class 9. Dictating machines, etc. Simon Sound Service, 48-50 George St., Portman Sq., W.1.

Vacmaster. 696,765. Class 9. Electric vacuum and domestic polishing machines. Vorwerk and Co., 48-64, Karolinenstrasse, Wuppertal-Barmer, Germany.

MEETINGS TO NOTE

THURSDAY, MAY 17

I.E.E. (S. Wales Centre).—"Safe Winding in Shafts." T. G. Dash, Park Place, Cardiff, 6 p.m.

I.E.E. (London).—Annual meeting at Savoy Place, 5.30 p.m.

FRIDAY, MAY 18

I.E.E. (Education Discussion Circle).—Questions Night. Savoy Place, 6 p.m.

SATURDAY, MAY 19

A.S.E.E. (Oxford Branch).—"Neon Sign, estimating, erection and maintenance by Contractors." H. Langdon-Down. S.E.B., George St., 3 p.m.

PURCHASING OFFICERS ASSOC.—One-day conference at N. British Station Hotel, Edinburgh.

MONDAY, MAY 21

A.S.E.E. (Central London branch).—"Suburban Railway Electrification." St. Ermin's Hotel, S.W.1, 6.50 p.m.

WEDNESDAY, MAY 23

I.E.E. (London Supply Section).—"Hydro-Electric Power Development in Scotland." Sir Edward MacColl. Savoy Place, 5.30 p.m.

I.E.E. (N. Midland Centre).—"Selection of Students for Courses." R. Harper. Lighting Service Bureau, Aire St., Leeds, 6 p.m.

MONDAY, MAY 28

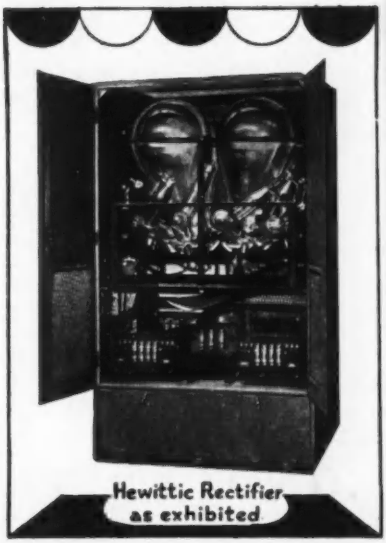
I.E.E. (London Measurements Section).—Conference on "Electrical Instrument Design." Continues until May 30.

WEDNESDAY, MAY 30

I.E.E. (Scottish Centre).—Annual meeting at Heriot-Watt College, Edinburgh, 7 p.m.

FESTIVAL OF BRITAIN

HERE in the General Electronic Section under the Dome of Discovery you will find a fine example of a modern electronic power unit—the Hewittic mercury arc rectifier—the equipment used for all forms of D.C. electric traction, light and power, and heavy duty industrial supply.



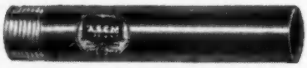
Hewittic Rectifier as exhibited

Hewittic Rectifiers REGD. TRADE MARK

HACKBRIDGE AND HEWITTIC ELECTRIC CO. LTD., WALTON-ON-THAMES, SURREY

Telephone: Walton-on-Thames 760 (8 lines) Telegrams: "Electric," Walton-on-Thames

"It's no trouble at all!"



Screwed & Socketed Gas Thread

Screwed & Socketed Conduit Thread

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How often one hears that remark but how *true* it is when you are working with Metallic Conduit Tube and Fittings. For quality and consistent accuracy—

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CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WANTED · FOR SALE WORK WANTED

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia St., London W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 35s. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

BOROUGH OF OSWESTRY

IMPROVED STREET LIGHTING SCHEME

TENDERS are invited for the following works in connection with the provision of improved lighting of Group A standard on the Swansea-Manchester A 483 Trunk Road within the Borough of Oswestry.

The work consists of provision, erection and wiring complete of 29 concrete columns, 12 varied brackets and one central suspension fitting together with 42 lanterns with H.P.M.V. lamp, gear, time switches, etc.

General condition of contract and plans may be seen at, and specification obtained from, the office of the Borough Surveyor, Guildhall, Oswestry.

Tenders in plain sealed envelopes endorsed "Street Lighting Tender" must be delivered to the undersigned not later than 10 a.m. on Friday, June 15, 1951. The council does not bind itself to accept the lowest, or any tender, and the provisionally accepted tender is subject to the approval of the Minister of Transport.

H. BIRD JONES,
Town Clerk.

Town Clerk's Offices,
Guildhall, Oswestry.
May 11, 1951. (K 714)

ST. NEOTS URBAN DISTRICT COUNCIL

IPSWICH—WEEDON TRUNK ROAD A.45
STREET LIGHTING IMPROVEMENT

TENDERS are invited for the installation of new street lighting to Group A standard along a section of the above mentioned road in St. Neots, extending from the River Bridge to Green End, a distance of approximately 1,048 yards. The works include the supply and erection of:

(*a*) 26 reinforced concrete columns.
(*b*) 1 wall mounting bracket and
(*c*) 27 lanterns with 140 watt Sodium discharge lamps complete with all auxiliary equipment and wiring.

Plans and general conditions of contract may be inspected and specification, bill of quantities and form of tender obtained from the undersigned upon payment of a deposit of £2 2s. returnable on receipt of a bona-fide tender.

Tenders in plain sealed envelopes endorsed "Street Lighting" must be forwarded to the undersigned not later than Saturday, June 16 next.

The council do not bind themselves to accept the lowest or any tender.

L. HENDERSON,
Clerk of the Council.

Council Offices, Huntingdon Street, St. Neots, Hunts.
May 2, 1951 (K 623)

STAINES URBAN DISTRICT COUNCIL

Worple Avenue Estate

INSTALLATION OF ELECTRICITY

TENDERS are invited from experienced firms for the installation of electricity in 94 existing houses on the Worple Avenue Estate, Staines. The work includes for providing all the necessary wiring, lighting points, switches, 5 amp and 15 amp points together with all incidental works.

A specification together with schedule of points, etc. and form of tender may be obtained on application to the Engineer and Surveyor, Engineer and Surveyor's Department, Shortwood House, 240 London Road, Staines, upon payment of a deposit of 2 gns., which will be returned upon receipt of a bona-fide tender not subsequently withdrawn.

Tenders must be enclosed in the envelope endorsed "Worple Avenue Estate" and delivered to the undersigned by 5 p.m. on Monday, May 28, 1951. The envelope must not bear any name or mark indicating the identity of the sender.

(*Continued in next column*)

(*Continued from previous column*)

The Council do not bind themselves to accept the lowest or any tender.

F. ENTWISTLE,
Clerk of the Council.

Council Offices, 29 Clarence Street,
Staines, Middlesex. (K 653)

APPOINTMENTS VACANT

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following appointments:

INSTRUMENT ENGINEER (Lombard Road Generating Station).

Applicants should have had experience on instruments as used in a power station, particularly boiler house and engine room types, and should be capable of the supervision of instrument fitters. Technical education should be at least up to Ordinary National Certificate standard.

Salary in accordance with N.J.B. Schedule, Class "F," Grade 13, £420 per annum, inclusive of London Allowance. It should be noted that this salary is provisional and subject to negotiation by the appropriate organisation.

ASSISTANT R. & M. ENGINEER (Planning Assistant) (Fulham Generating Station).

Candidates should have had experience in power station operation and maintenance, together with technical training up to Higher National Certificate standard. They should possess organising ability and have had experience in the handling of correspondence.

Salary in accordance with N.J.B. Schedule, Class "K," Grade 12, £580 2s. per annum, inclusive of London Allowance.

JUNIOR ENGINEERS (West Ham Generating Station).

Applications are invited for the above positions for general duties in the station.

Applicants should have had sound training up to approximately Higher National Certificate standard and should also possess practical experience of power station plant.

Salary in accordance with N.J.B. Schedule, Class "G," Grade 14, £437 per annum, inclusive of London Allowance.

All the foregoing posts are superannuable.

Applications, stating age, qualifications and experience, should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, Westminster S.W.1, to be received within fourteen days of the appearance of this advertisement.

J. N. WAITE,
Divisional Controller.
(K 691)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointments:—

JUNIOR ENGINEER—LUTON GENERATING STATION.

Salary in accordance with Clause 35 of the N.J.B. Schedule "A," Class "E," Grade 14, £375 to £387 per annum.

Preference will be given to applicants who have had previous experience in a generating station and who have reached the standard of the Ordinary National Certificate in Electrical Engineering or its equivalent. Previous experience with rotary converting plant will be an advantage. The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards superannuation scheme.

Applications, stating age, experience and present position should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to arrive not later than May 25, 1951. Envelopes should be endorsed "Junior Engineer—Luton."

W. N. C. CLINCH
Controller.

Northmet House, Southgate, N.14. (K 710)

ELECTRICITY SUPPLY COMMISSION OF THE UNION OF SOUTH AFRICA

RAND UNDERTAKING

THE Rand Undertaking of the Electricity Supply Commission of the Union of South Africa invites applications for the positions enumerated below.

The Undertaking operates seven steam stations with two more under construction; the sustained load exceeds 900 MW and is expected to exceed 1,500 MW in the course of the next few years; annual sales are now in excess of 5,000 million. The area of supply is 28,000 square miles centred on Johannesburg, with transmission at 132 and 88 kV and distribution at 88, 42, 21 kV and lower voltages.

The salaries stated are the minimum starting salaries. In addition cost-of-living allowance is paid based on a sliding scale, and is at present £185 per annum. Actual commencing salaries will be determined by qualifications and experience. All positions offer good prospects of advancement to men of ability, energy and initiative.

Pension

On appointment to the Permanent Staff employees are required to join the E.S.C. Pension Fund, to which their contribution is approximately 6 per cent. of their salary.

Leave

Leave is granted on the following scale:—

Class	1	2	3
Salary scale	£720 and over	£480-£719	£300-£479
Weeks per annum, of which one week may be accumulated	4	4	4
Bonus leave: Weeks per annum	2	1	0

Bonus leave at the above rate accrues after the completion of five years' service.

Favourable sick leave privileges.

Passage to South Africa

Rail and sea passage in class appropriate to position will be provided for selected applicants provided they agree to serve the Commission for at least two years.

Applications marked "Rand Undertaking Vacancies," stating age, place of birth, whether married or single, details of general and technical education, qualifications, details of engineering experience and positions held, with copies of testimonials, should be addressed to:

The London Representative,
Electricity Supply Commission (South Africa),
535-546 The Adelphi,
London W.C.2.

ASSISTANT CONSTRUCTION ENGINEER

System Extension Construction Department

This department is responsible for the erection of 132 kV, 88 kV, 40 kV and lower voltage overhead lines and for the installation of electrical equipment of similar voltages in distribution stations and sub-stations. The occupant of the above post will assist the System Construction Engineer in the general administration of the Department and should have had sound technical training and possess organising ability with previous experience in the control of personnel and in the construction and installation of electrical equipment and transmission lines. Salary £1,100 per annum, plus cost-of-living allowance.

CONTROL ENGINEERS

System Operation Department

Applicants should possess a B.Sc. Degree in Electrical Engineering or equivalent technical qualification and have had considerable practical experience in the operation of large interconnected power stations and transmission and distribution systems. Duties will comprise supervision of all plant loading and switching operations during an 8-hour shift (48-hour week). Salary, £800 per annum plus cost-of-living allowance.

SENIOR ASSISTANT TESTING ENGINEER

To assist the Testing Engineer in the general administration and supervision of the protection section of the Testing Department. Applicants must have sound technical knowledge of, and practical experience in, the development, selection, installation and maintenance of protective equipment on a large power supply system, and also have experience in semi-automatic and automatic control equipment. Experience in organising and controlling staff is essential. The possession of a B.Sc. Degree in Electrical Engineering or equivalent technical qualification and/or corporate membership of the Institution of Electrical Engineers would be a primary recommendation. Salary £930 per annum, plus cost-of-living allowance.

CONSTRUCTION SUPERVISOR AND ASSISTANT CONSTRUCTION SUPERVISOR

System Extensions Construction Department

Applicants will be required to organise and supervise the installation of 132 kV, 88 kV, 40 kV and lower voltage equipment in distribution stations and sub-stations and should have sound technical knowledge and previous practical experience commensurate with the above requirements.

The salary for the Construction Supervisor is £720 per annum and for the Assistant Construction Supervisor £582 per annum, in each case plus cost-of-living allowance.

SECTIONAL ENGINEERS

Distribution Department

A Sectional Engineer is responsible for the general administration of a section of the system and for the supervision of the operation and maintenance of 132 kV, 88 kV, 40 kV and lower voltage distribution stations, sub-stations, transmission and distribution circuits of that section.

The possession of a B.Sc. Degree in Electrical Engineering or equivalent and/or corporate membership of the Institution of Electrical Engineers would be a primary recommendation.

Applicants should possess organising ability and have had previous practical experience commensurate with the above duties. Salary £720 per annum, plus cost-of-living allowance, and housing at concession rental.

POWER STATION ASSISTANT RESIDENT ENGINEERS

Applicants should have had a sound technical training and considerable practical experience in the operation of steam generating plant, main and auxiliary switchgear and in the control of power station personnel.

Salary £720 per annum, plus cost-of-living allowance, with the eventual occupation of a house at concession rental.

SHIFT ENGINEERS AND JUNIOR SHIFT ENGINEERS

Applicants should have had a good technical training and sound practical experience in the operation of steam generating plant and main and auxiliary switchgear.

Salary for Shift Engineer, £618 per annum, and for Junior Shift Engineer £516 per annum, in each case plus cost-of-living allowance, with the possibility of occupying a house at concession rental.

ASSISTANT TESTING ENGINEERS

To carry out the installation, testing and maintenance of protective and automatic control equipment on a large power supply system. Applicants should possess a B.Sc. Degree in Electrical Engineering or equivalent technical qualification, have served a two-year pupilage and had subsequent practical experience with protective and control equipment. Salary £630 per annum, plus cost-of-living allowance.

ASSISTANT DISTRICT ENGINEERS

Applicants should have good technical knowledge and will be required to assist in the operation and maintenance of 132 kV, 88 kV, 40 kV and lower voltage distribution stations and sub-stations and the operation, maintenance and repair of transmission and distribution lines. Previous experience on similar work essential. Salary £444 per annum plus cost-of living allowance, and housing at concession rentals to married men. (K 545)

NORTH WESTERN ELECTRICITY BOARD

No. 1 Sub-Area

APPLICATIONS are invited for the following appointments:—

THIRD ASSISTANT ENGINEER (Building Construction).

The successful applicant will be required to give general assistance to the Sub-Area Building Construction Engineer in the control and operation of a sub-section composed of members of all trades in the building industry. The work involves repair and maintenance of all premises within the Sub-Area, and the erection of new substations, office blocks, etc.

Applicants must have had a wide experience in the direct control of labour, supervision of contractors, estimating and costing, and practical experience in building design will be considered an advantage.

The salary for the post will be in accordance with the National Joint Board Revised Agreement, Class "M," Grade 10, i.e. £727/£739/£751 per annum. The post is superannuable.

SECOND ASSISTANT DISTRICT ENGINEER. (North West District)

The duties will include the supervision of the erection and maintenance of substation switchgear, laying and jointing of cables, and switching operations on the h.v. and l.v. systems within the District as required.

Applicants should have had a wide general experience on the distribution side of electricity supply. Corporate membership of the Institution of Electrical Engineers will be an advantage.

The salary will be in accordance with the National Joint Board Revised Agreement, Class "F," Grade 7, i.e. £625/£634/£643 per annum.

Applications for the above posts, stating age, education, qualifications and experience, present post and salary, should be received by the Sub-Area Secretary, No. 1 Sub-Area, The North Western Electricity Board, Town Hall Extension, Manchester 2, P.O. Box No. 493, not later than Saturday, May 26, 1951.

No. 3 Sub-Area

SECOND ASSISTANT ENGINEER (Operation and Maintenance)

Applications are invited for the appointment of Second Assistant Engineer (Operation and Maintenance) in the Sub-Area Mains Engineer's Department at No. 3 Sub-Area Headquarters, Union Street, Oldham.

The salary for the post will be in accordance with the National Joint Board Revised Agreement, Class "J," Grade 7, i.e. £736/£753/£770 per annum.

Applicants should have had a wide experience in the operation and maintenance of sub-stations and large industrial and rural high voltage and low voltage networks, including both overhead lines and underground cables of voltages up to and including 33kV; also experience in high voltage testing and fault localising.

Corporate membership of the Institution of Electrical Engineers will be an advantage.

Applications, stating age, education, qualifications and experience, present post and salary, should be received by E. Binns, Esq., M.I.Mech.E., A.M.I.E.E., Sub-Area Manager, The North Western Electricity Board, No. 3 Sub-Area Headquarters, Union Street, Oldham, not later than Saturday, May 26, 1951. (K 713)

CROWN AGENTS FOR THE COLONIES

INSTALLATION SUPERINTENDENT (a) and DISTRIBUTION SUPERINTENDENT (b) required by the Government of Sierra Leone for the Electricity Branch of the Public Works Department for one tour of 18 to 24 months with prospect of permanency. Salary according to qualifications and experience in scale £723 a year, rising to £1,060 a year (including allowances). Outfit allowance £60. Free passages. Liberal leave on full salary. Candidates, preferably not over 40 years of age, should possess an Ordinary or Higher National Certificate. For post (a) they must have served an apprenticeship in the consumers' section of an Electricity Undertaking and have had experience in the installation of power and lighting circuits to comply with the Institute of Electrical Engineers' regulations. Experience in the erection of conduit systems would be an advantage and some experience in the testing of single-phase kilowatt-hour meters is important. Practical experience in an electrical workshop on the repair of motors, motor starters, electric cookers, etc., is desirable. For post (b) they must have served an apprenticeship with a public supply undertaking and have had several years' practical experience in the installation of underground cable systems at 11 kV and 3.3 kV and 400/230 volt, and be thoroughly conversant with fault-location methods. Experience with the erection and operation of overhead H.V. and L.V. lines would be an advantage. They should also have had experience in the erection and maintenance of switchgear (H.V. and L.V.) and power transformers, and be able to plan improvements to and development of distribution systems. Apply at once by letter, stating age, full names in block letters, and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4 Millbank, London S.W.1, quoting for post (a) M.28555.B., and for post (b) M.28555.B. on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration. (K 688)

LONDON ELECTRICITY BOARD

DRAUGHTSMEN AND ENGINEERING DRAUGHTSMEN

APPLICATIONS are invited for the following vacancies in the Drawing Office of the Chief Engineer's Department in Central London.

(Ref.: V.1232/T.) Experienced Engineering Draughtsmen for plant layout. Applicants should preferably have served an engineering apprenticeship or recognised training course and have had good technical training together with experience in the layout of transforming plant, switchgear and cables for operation on voltages up to 66 kV. A knowledge of modern protective systems would be an advantage. Salary from £500 per annum inclusive.

(Ref.: V.1233/T.) Draughtsmen experienced in E.H.V. cable route surveying. Applicants should have had good experience in making accurate surveys of cable routes during the laying of E.H.V. cables, taking information and sketching on site and producing final drawings. Salary from £400 per annum inclusive.

The above salaries are provisional, pending grading of the posts under the national agreement of the appropriate negotiating body, and the commencing salaries will be determined according to qualifications and experience.

Application forms obtainable from Establishments Officer, 46 New Broad Street, E.C.2, to be returned duly completed within 10 days, quoting clearly the reference number of the vacancy for which application is made. Please enclose addressed foolscap envelope and quote relevant reference on all correspondence. (K 683)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for two vacancies of GENERAL ASSISTANT ENGINEER in the Protective Gear Section of the Technical Department. The salary for each of these appointments will be in accordance with Schedule "C," Grade 8, of the National Joint Board Agreement, commencing within the range £437 to £569 per annum according to qualifications and experience, and rising ultimately to £622 per annum.

Applicants should possess either a University Degree or the Higher National Certificate in electrical engineering, and should have spent some time in the electrical manufacturing or supply industry. Previous experience of protective gear will be considered an advantage.

Conditions of service will be in accordance with the N.J.B. Agreement, and superannuation under terms approved by the British Electricity Authority.

Forms of application may be obtained from the Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, and should be returned not later than June 2, 1951.

F. W. LAWTON,
Divisional Controller.
(K 693)

SOUTHERN ELECTRICITY BOARD

APPLICATIONS are invited for the following post:
ASSISTANT ENGINEER (Substation Maintenance)

Portsmouth District of No. 3 (Portsmouth) Sub-Area. Salary, N.J.B. F/8/1, £565 per annum, N.J.B. conditions of service.

Duties will include assisting the maintenance and operation engineer with the maintenance of plant and equipment at outdoor and indoor substations on both urban and rural systems.

Applicants should have received a good technical training, preferably equivalent to H.N.C. standard, and should have had experience of the testing and maintenance of plant and equipment.

The successful candidate will be required to contribute to the B.E.A. and Area Board's superannuation scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him in envelopes endorsed "Assistant Engineer, Portsmouth" not later than ten days after the appearance of this notice.

F. W. KEMPTON,
Secretary.
(K 689)

BRITISH ELECTRICITY AUTHORITY

North-Western Division

Vacancy No. 437

APPLICATIONS are invited for the position of ASSISTANT SHIFT CHARGE ENGINEER at the Kearsley Generating Station, Stoneclough, near Manchester.

Salary range £687 to £715 per annum, in accordance with Grade 9, Class "K".

Candidates for this position (which is superannuable) should preferably possess technical qualifications, and previous experience in a large modern generating station is essential.

Applications, stating age, qualifications, present position, and giving full details of education and experience, should be received by The Establishment Officer, British Electricity House, Wilmslow Road, East Didsbury, Manchester 20, not later than May 25, 1951. (K 684)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the appointment of SHIFT CHARGE ENGINEER at Birchills Generating Station, Class "D," Grade 7, commencing salary £563 per annum.

Applicants should hold Higher National Certificate in electrical and mechanical engineering or an equivalent qualification and should have had sound technical training and practical experience in the control and operation of steam generating plant and main switchgear, or mechanical and electrical experience in a manufacturer's works. Qualified marine engineers with electrical experience would be considered suitable.

Salary and conditions of service will be in accordance with the N.J.B. Agreement, and superannuation under terms approved by the British Electricity Authority.

Applications should be made on forms obtainable from the Divisional Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, and should be returned not later than June 2, 1951.

F. W. LAWTON,
Divisional Controller.
(K 694)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

SHIFT CHARGE ENGINEER
STAYTHORPE GENERATING STATION

APPLICATIONS are invited for the position of Shift Charge Engineer at Staythorpe Generating Station, near Newark, Notts.

Applicants should have a sound technical training and practical experience in the operation and control of steam generating plant and switchgear and preference will be given to candidates who have the Higher National Certificate or equivalent qualification.

The salary will be in accordance with Class "J," Grade 7 (£736 to £770 per annum) of the National Joint Board Schedule and the post will be superannuable within the provisions of the B.E.A. and Area Boards' Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, Barker Gate, Nottingham, and should be returned not later than June 1, 1951.

W. S. BURGE,
Divisional Controller.
May 9, 1951. (K 692)

BRITISH ELECTRICITY AUTHORITY

North-Western Division

VACANCY NO. 389

APPLICATIONS are invited for positions as SHIFT CHARGE ENGINEERS at the Wigan Generating Station, Bradford Place, Wigan.

The salary range for these positions, which are superannuable, will be £563/£573 per annum, in accordance with Grade 7, Class "D."

Candidates should preferably possess technical qualifications, and previous experience in a generating station is desirable.

Applications made in respect of the previous advertisement of this vacancy will automatically receive consideration.

Applications, quoting vacancy number, stating age, qualifications, present position and giving full details of education and experience, should be received by the Establishment Officer, British Electricity House, Wilmslow Road, East Didsbury, Manchester 20, not later than May 31, 1951. (K 709)

HIS MAJESTY'S COLONIAL SERVICE

Gold Coast

TWO vacancies exist for BROADCASTING ENGINEERS in the Broadcasting Department, Gold Coast. Appointment is on three years probation for pensionable employment in the salary scale £720 to £1,300, the point of entry being determined by war service and approved experience. In addition a temporary allowance of £114 to £150 is payable.

Free passages are granted to an officer, his wife and up to three children under the age of eight, once each way each tour. Furnished quarters, if available, are provided at a rent of £60 to £90 per year according to salary, and leave is granted at the rate of one week for each month of resident service after a tour of 18 to 24 months.

Candidates must be under the age of 40, be Graduates of the Institution of Electrical Engineers, and have at least two years' practical experience of wireless engineering work. They should write for further particulars and a form of application to the Director of Recruitment (Colonial Service), Colonial Office, Sanctuary Buildings, Great Smith Street, London, S.W.1, giving brief details of age, qualifications and experience, mentioning this paper and quoting No. 27326/44. (K 687)

SOUTH WEST SCOTLAND ELECTRICITY BOARD

Clyde Sub-Area

APPOINTMENT OF SENIOR ASSISTANT ENGINEER, PLANNING AND DEVELOPMENT

APPLICATIONS are invited for the position of Senior Assistant Engineer in the Planning and Development Section of the above Sub-Area.

Applicants should possess a Degree in electrical engineering or have equivalent qualifications and have a wide experience in the design and layout of large underground and overhead distribution systems at pressures up to and including 33 kV in industrial and residential areas. A knowledge and application of modern protection equipment, the calculation of fault levels and the preparation of load flow diagrams is essential.

The salary for the post will be in accordance with the National Joint Board Agreement, Class "J", Grade 4, i.e. £939 to £983 per annum.

The successful applicant will require to satisfy the Board's medical adviser and contribute to a superannuation scheme.

Applications, stating age, education, qualifications, experience, present position and salary, should be received by The Manager, The South West Scotland Electricity Board, Clyde Sub-Area, 206 St. Vincent Street, Glasgow, C.2, not later than 14 days after the appearance of this notice. (K 686)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

SECTION ENGINEER, COVENTRY

APPLICATIONS are invited for the position of Section Engineer in the Transmission Department, to be located at Coventry.

Salary will be within Class "AX/DX," Grade 4 of the Schedule C of the National Joint Board Agreement (£884-£890 per annum).

Candidates must have had experience in the maintenance and operation of 132 kV High Voltage overhead lines, outdoor transformer and switching stations in a Transmission Section and must be Corporate Members of the I.E.E.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, British Electricity House, Barker Gate, Nottingham, and should be returned not later than May 25, 1951.

W. S. BURGE,
Divisional Controller.
(K 673)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER,
STAYTHORPE GENERATING STATION

APPLICATIONS are invited for the post of Assistant Shift Charge Engineer at Staythorpe Generating Station, near Newark, Notts.

The salary will be in accordance with Class "J," Grade 9, of the National Joint Board Agreement (£646-£674 per annum).

Applicants should have had a sound technical training with practical experience in the operation and control of modern generating plant.

The post will be superannuable within the terms and conditions of the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity House, Barker Gate, Nottingham, and returned not later than May 25, 1951.

W. S. BURGE,
Divisional Controller.
(K 674)

BRITISH ELECTRICITY AUTHORITY

London Division

BOILER HOUSE SHIFT CHARGE ENGINEER
DEPTFORD EAST GENERATING STATION

APPLICATIONS are invited from candidates who have received a sound technical training in mechanical engineering, steam generation and combustion of fuel. Previous experience in charge of steam raising plants is essential, but not necessarily in power stations.

The successful applicant will be required to take charge of shift operation of steam raising and associated plant.

Salary in accordance with N.J.B. Schedule, Class "H," Grade 9, plus London Allowance, £639 per annum.

The appointment will be superannuable.

Applications, stating age, qualifications and enclosing copies of testimonials, should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Westminster S.W.1, to be received within fourteen days of the appearance of this advertisement.

J. N. WAITE,
Divisional Controller.
(K 690)

SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the position of SECOND ASSISTANT ENGINEER (Planning and Development Section) in the Chief Engineer's Department of the Board at St. Mellons, Cardiff. Candidates should have had a sound engineering training and considerable experience of distribution work on heavily loaded urban and industrial systems and extensive rural areas. They should have educational qualifications not less than those required for associate membership of the Institution of Electrical Engineers.

The salary for the position will be in accordance with Class "AX," Grade 2 (£752-£884) and thence, on present classification to Class "CX" (£920-£938).

Applications, stating age, qualifications and experience, present position, present salary and whether married or single, together with the names and addresses of three referees, should be addressed to the Secretary (Establishments Section), The South Wales Electricity Board, St. Mellons, Cardiff, so as to reach him not later than May 31, 1951.

D. G. DODDS,
Secretary.
(K 725)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointments in the Generation Construction Department at Divisional Headquarters:

SENIOR DRAUGHTSMEN (MECHANICAL)

The commencing salary will be within the range of £525-£735 per annum, according to age and experience.

Applicants should be in possession of the Higher National Certificate, or equivalent, and preferably have served a recognised apprenticeship course. They should be familiar with one or more of the following:

Generating station lay-out and design, coal handling plant, ash and dust-handling system and pipework systems.

The salary is provisional and will be subject to negotiation through the medium of the appropriate negotiating body.

The appointments will be superannuable in accordance with the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications, stating age, experience and present position, should be sent in envelopes endorsed "Senior Draughtsmen (Mechanical)", to arrive not later than May 26, 1951, to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14.

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, N.14. (K 646)

SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the position of THIRD ASSISTANT ENGINEER in the Chief Engineer's Department of the Board at St. Mellons, Cardiff.

Applicants should have had a sound engineering training, have a good knowledge of distribution practice, and should also have had some experience in the collection, tabulation and analysis of technical data relating to distribution systems. Experience in the calculation of load flows and the assessment of system fault levels is also desirable.

The salary for the position will be in accordance with Class "AX," Grade 5, of the National Joint Board Schedule (£579/£710) and thence, on present classification to Class "CX" (£738/£753).

Applications stating age, qualifications and experience, present position, present salary, and whether married or single, together with the names and addresses of three referees, should be addressed to the Secretary (Establishments Section), The South Wales Electricity Board, St. Mellons, Cardiff, so as to reach him not later than May 31, 1951.

D. G. DODDS,
Secretary.
(K 726)

SOUTH EASTERN ELECTRICITY BOARD

Medway District

DEMONSTRATOR

SALARY of £310 by £20 to £390 per annum under the N.J.C. Agreement, Grade 1. Superannuation will be arranged. Applicants must be fully experienced in demonstrating to consumers in their own homes all types of domestic electric appliances and be able to organise and conduct public lectures. Appropriate domestic science or housecraft qualifications an advantage.

Applications, giving two referees, must reach H. F. Knell, J.P., M.I.E.E., Kent Manager, South Eastern Electricity Board, 178-184 High Street, Rochester, Kent, by May 28, 1951.

A. L. BURNELL,
Secretary.

May, 1951. (K 724)

EASTERN ELECTRICITY BOARD

Suffolk Sub-Area

APPLICATIONS are invited for the following appointments in the:—

SUB-AREA HEADQUARTERS, STOWMARKET
ASSISTANT COMMERCIAL ENGINEER

Candidates should preferably be corporate members of the Institution of Electrical Engineers and should have had a sound engineering training and a wide experience of industrial installations and of the application and utilisation of electricity for commercial and industrial purposes. The successful candidate will be required to negotiate tariffs and conditions for supplies of electricity for industrial purposes, to give specialist advice on utilisation, and to assist in the co-ordination of development of power sales generally.

The annual provisional salary for the appointment will be £675.

Applications should be addressed to The Manager, Suffolk Sub-Area, Eastern Electricity Board, Finborough Hall, Stowmarket.

WOODBRIDGE DISTRICT
FIRST ASSISTANT DISTRICT ENGINEER

Candidates should have had a sound technical training and wide experience in the planning, construction, operation, and maintenance of h.v. and l.v. overhead and underground systems, including sub-stations, in a predominantly rural area.

The salary for the appointment will be in accordance with Class 'B," Grade 5, of the National Joint Board Salary Agreement, commencing at £556 per annum.

Applications should be addressed to The District Manager, Woodbridge, Eastern Electricity Board, Cumberland Street, Woodbridge, Suffolk.

BURY ST. EDMUNDS DISTRICT
SECOND ASSISTANT ENGINEER

Candidates should have had a sound technical training and experience in the construction, operation, and maintenance of h.v. and l.v. overhead and underground systems in a predominantly rural area.

The salary for the appointment will be in accordance with Class "D," Grade 7, of the National Joint Board Salary Agreement, commencing at £563 per annum.

Applications should be addressed to The District Manager, Bury St. Edmunds, Eastern Electricity Board, 4 Cornhill, Bury St. Edmunds, Suffolk.

Both future salaries and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications, stating age, education, qualifications, and experience, with details of present appointment and salary, should be addressed to the person concerned so as to reach him within 14 days of the appearance of this advertisement. (K 723)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the appointment of DISTRICT ENGINEER in the St. Helens District of the Board's No. 2 Sub-Area. Applicants must be Chartered Electrical Engineers and have had considerable experience in the operation and maintenance of networks up to 33kV in an industrial area.

The salary payable will be in accordance with the revised schedule of the National Joint Board, Class "F," Grade 2, i.e. £916-£937-£958 per annum. The appointment will be superannuable and subject to medical examination.

Forms of application can be obtained from the Manager, No. 2 Sub-Area, Merseyside and North Wales Electricity Board, Sandiway House, near Northwich, Cheshire, to whom completed forms should be returned so as to be received not later than May 28, 1951.

JAMES RANKIN,
Secretary. (K 711)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the appointment of JUNIOR ENGINEER in the Southport District of No. 1 Sub-Area, at a salary of £375 per annum (N.J.B., Class "E," Grade 14).

Applicants must have received a thorough technical training and obtained the Higher National Certificate in Electrical Engineering or equivalent qualification and possess some experience in the design, construction and operation of h.v. networks, substations and m.v. networks up to and including 6.6kV.

The appointment is superannuable and subject to medical examination.

Applications, on forms obtainable from the Manager, No. 1 Sub-Area, 24 Hatton Garden, Liverpool 3, should be completed and returned so as to be received not later than May 26, 1951.

JAMES RANKIN,
Secretary. (K 712)

BRITISH ELECTRICITY AUTHORITY

Chief Engineer's Department

SENIOR DRAUGHTSMEN AND DRAUGHTSMEN

APPLICATIONS are invited for the following vacancies in the Drawing Office at Headquarters in London: SENIOR DRAUGHTSMEN and DRAUGHTSMEN experienced in one of the following: (*a*) Generating station layout or on plant in connection therewith; (*b*) Layout of 132 kV substations and/or preparation of schematic and protection diagrams; (*c*) Light civil engineering and/or building works.

The salaries will be in accordance with qualifications and experience within the following provisional salary ranges: Senior Draughtsmen (over 25 years of age) £500 to £700 per annum plus London Allowance; Draughtsmen £375 to £500 per annum plus London Allowance.

All the appointments are superannuable.

A further vacancy exists for a JUNIOR DRAUGHTSMAN, aged approximately 16 years. The salary will be in accordance with the National Joint Council General Clerical Scale £150 per annum at 16, £225 per annum at 20, rising to a maximum of £415 per annum, including London Allowance.

Application forms may be obtained from the Secretary's Office (Establishments), Applications Section, British Electricity Authority, British Electricity House, Great Portland Street, London, W.1, and should be completed and returned to D. Moffat, Director of Establishments, not later than June 1, 1951.

Please quote reference AE/171. (K 615)

YORKSHIRE ELECTRICITY BOARD

No. 6 (Hull) Sub-Area

APPLICATIONS are invited for the following appointments:—

SECOND ASSISTANT DISTRICT ENGINEER (Meters Testing and Protection)—Hull (Vacancy No. 61/51).

Applicants should have technical qualifications equivalent to corporate membership of the Institution of Electrical Engineers, and must have had experience of protective equipment on 66 kV, 33 kV, 11 kV, and l.v. power systems. Experience of mains fault location will be an advantage.

The successful candidate will be expected to supervise installation work on the protective equipment on all the various power systems in the Sub-Area.

Salary—N.J.B. Agreement, Class "J," Grade 7, £736/£770 per annum.

THIRD ASSISTANT DISTRICT ENGINEER (Meters Testing and Protection)—HULL (Vacancy No. 61/51).

Applicants should be graduates of the Institution of Electrical Engineers or possess equivalent qualifications, and should have a sound knowledge of automatic protective gear with some experience in the commissioning and maintenance of equipment. Experience of h.v. testing and h.v. cable fault location will be an advantage.

Salary—N.J.B. Agreement, Class "J," Grade 10, £609/£633 per annum.

Applications, stating the above vacancy numbers, and giving full details of age, qualifications, and experience, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, within fourteen days of this advertisement. (K 722)

A LEADING manufacturer of insulated electric wire and cables with expanding commercial interests, has a vacancy in the Midlands for a SALES REPRESENTATIVE. Applicants must be experienced in this class of product and have some training in electrical engineering. Commencing salary approximately £500 p.a. with good prospects. Men having previous experience of cable selling and in operating from cable branch preferred. Candidates will be interviewed in London.—Write, stating age and full details of experience, to Box No. 6039, Electrical Times. (K 701)

CONTRACTS ENGINEER for H.T. and L.T. switchgear and transformer tenders and contracts. House available if required within short period.—Apply, stating technical qualifications, experience and salary required, to Personnel Manager, South Wales Switchgear, Ltd., Blackwood, Mon. (K 696)

A VACANCY has occurred for the position of SENIOR ELECTRICAL AND MECHANICAL ENGINEER with first-class qualifications on the staff of a well-known electrical contracting firm in London. Experience of contracting as opposed to manufacture essential. A salary of £1,000 per annum is offered to the successful applicant.—Write, stating education, qualifications, age and experience to Box No. 6041, Electrical Times. (K 702)

ARMATURE WINDER required in repair and rewind department. Excellent prospects and rates.—Max Arc and Electrics, Ltd., 190 Thornton Road, Croydon. (K 494)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

FOR INDIA

AN old established and well-known company in India, representing several reputable English manufacturers, requires an

ELECTRICAL SALES ENGINEER

normally for employment in Bombay or Calcutta or Madras. Age preferred: 22 to 28. Applicant must hold degree in electrical engineering, or equivalent, from a U.K. university, and have had two years' practical experience with an approved U.K. manufacturer. Preference given to man having training and experience with switchgear manufacture and estimating. Three years agreement and six months' leave (with pay) from India if offered second agreement after termination. Initial kit allowance, £75. First-class passages. Monthly salary for single man 1,100 rupees first year, 1,200 rupees second year, 1,300 rupees third year, plus local monthly allowance 250 rupees. Additional allowance if married. Mutual contributory provident fund. Application must give full details of education, qualification, training and experience, and will be treated confidentially.

Apply Box No. 6029, Electrical Times.

(K 635p)

ALBRIGHT AND WILSON LTD. have a vacancy for an ELECTRICAL ENGINEER, primarily for maintenance and development work at their Widnes factory. Candidates should be aged 24-28 and possess a degree in electrical engineering or be completing their degree course this summer. Salary £500-£700 according to age, qualifications and experience. A bonus is normally payable and a superannuation scheme is in operation. Applications should be sent to The Appointments Officer, Albright and Wilson Ltd., Oldbury, Birmingham. (K 706)

DRAUGHTSMEN AND ENGINEER DESIGNERS required, experienced in the layout of electrical switch and control boards, diagrams of connections or electrical control gear. Good remuneration for men of first class experience.—Apply, quoting "Switchgear", to Staff Manager, General Electric Co., Ltd., Witton, Birmingham 6. (K 699)

DRAUGHTSMEN experienced shop layouts, air, water, gas services, etc. Buildings, heavy plant foundations, mechanical handling, etc., for expansion programme.—Apply, stating age, experience, etc., to Box No. 5083, Electrical Times. (K522)

DRAUGHTSMEN wanted by makers of industrial electrical control gear. London area.—Full details, experience, age, salary, to Box No. 6047, Electrical Times. (K 717)

ELECTRICAL DRAUGHTSMAN, familiar with light mechanisms or instruments and preferably with some circuit experience, required by Dowty Equipment, Ltd., Arle Court, Cheltenham, for their electrical development department. Age 21-25. Higher National Certificate preferred. The factory is ideally situated in the grounds of a country house and working conditions are excellent. Write to Personnel Manager, stating age, experience and salary required. (K 564)

ELECTRICAL ENGINEER DRAUGHTSMAN required with experience in the design and installation of power and lighting schemes, distribution and control diagrams, etc. Excellent prospects for suitable men offered by Tees-side firm.—Apply, giving full particulars, quoting reference F.D., to Box No. 6027, Electrical Times. (K 658)

ELECTRICIAN FOREMAN required for East London firm with factories in Homerton and Essex. Apprenticeship and knowledge to Higher National Certificate standard and some factory experience essential. This is a post which can develop with the competence of the holder.—Please reply, giving details of experience and salary required, to Box No. 6037, Electrical Times. (K 700)

ELECTRICAL MAINTENANCE ENGINEER, married and between 30 and 35 years of age, required for factory operating continuous process. Starting salary £450 per annum, and free modern semi-detached house.—Please write, giving particulars of technical training and practical experience, to Box No. 6015, Electrical Times. (K 625)

ELECTRICAL ENGINEER required for Mddle East duty by large oil company. Honours degree and/or A.M.I.E.E., with experience in h.t. and l.t. overhead and underground transmission and distribution systems; installation and operation of medium-sized diesel power stations; industrial and domestic installations for power and lighting and operation of an electrical workshop. Age limits, 30 to 40. Substantial salary and allowances; free furnished quarters (messing or allowances in lieu); paid home leave at two-yearly intervals; initial period of separation from family.—Write, giving full details of experience and quoting No. 75, to Box 4203, c/o Charles Barker and Sons, Ltd., 31 Budge Row, London E.C.4. (K 729)

ENGINEERS required for all types of power cable installations, including underground, generating stations, etc. Opportunity to serve abroad.—Applicants should state experience and salary expected to Ref. 410, Siemens Brothers and Co., Ltd., Woolwich, S.E.18. (K 640)

EXPERIENCED ENGINEERS accustomed to the erection of lattice tower, concrete and wood pole overhead transmission lines and willing to serve either at home or overseas, age 25-45. Good prospects and pension.—Apply, in writing, giving full details to Staff Officer, British Insulated Callender's Construction Co. Ltd., 21 Bloomsbury Street, London W.C.1. (K 703)

FIRST-CLASS PLANNING AND METHODS ENGINEER required to apply most modern assembly methods to manufacture of small electro-mechanical products. West London area.—Write, giving age, full details of experience and salary required to Box No. 6051, Electrical Times. (K 719)

FULLY experienced CHIEF DRAUGHTSMAN DESIGNER required by leading manufacturer of light domestic switches, etc., in West London. Capable of taking charge of all final drawing development work and of staff. Experience in design work of the highest technical standards essential.– Salary required and full record of experience to Box No. 6031, Electrical Times. (K 679)

JUNIOR ENGINEERS and LABORATORY ASSISTANTS required for the development of instruments, meters and relays. University Degree or Higher National Certificate standard required.—Apply, in writing, stating age, experience and salary required, marking envelopes "Meter," to Personnel Manager, Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester 17. (K 698)

LIFT DRAUGHTSMEN, senior and junior, for layout and for mechanical and electrical departments. Good prospects for advancement. South Midland area. 40-hour, five-day week. Salary according to age and qualifications.—Box No. 6055, Electrical Times. (K 721)

MALES required as TESTERS on electrical measuring instruments. Experience desired, but not essential. Good opportunities for young men with National Certificate or equivalent. Write for interview, state age and previous experience, Sangamo Weston Ltd., Cambridge Road, Enfield, Middlesex. (K 682)

PLUMBER JOINTER. Experienced man required immediately for work on cables up to 11 kV. Must be willing to travel.—Details in writing to Box No. 6053, Electrical Times. (K 720)

POWER-HOUSE SHIFT ENGINEER required for Middle East appointment with large oil company. Applicants, preferably under 35, should have had regular training in electrical and mechanical engineering with technical qualification of H.N.C. standard. Practical experience should include time spent in modern central generating station, comprising w/t boilers, turbo-alternators, h.t. switchgear. Salary incremental from £600 plus allowances £300-£620 dependent on marital circumstances and free furnished quarters. Pensionable service. Biennial (paid) home leave.—Write, with full informative detail and quoting No. 87, to Box 4214, c/o Charles Barker and Sons Ltd., 31 Budge Row, London E.C.4. (K 730)

QUALIFIED ELECTRONIC ENGINEER is urgently required for the test and development departments of well-known automobile manufacturing company. Applicants should at least hold a H.N. Certificate Electrical Engineering and preferably a degree, also should have had some previous experience in the practical aspects of this type of work. Salary according to age, experience, and qualifications, with sound prospects.—Apply, Box No. 6043, Electrical Times. (K 715)

REPRESENTATIVE. Old established manufacturers require well-connected Sales Representative, able to handle additional line of domestic and light industrial switchgear, covering Cheshire, Yorkshire, Lancashire, Northumberland and Durham area.—Full details in the first instance to Box No. 6019, Electrical Times. (K 654)

REQUIRED FOR MIDDLE EAST. All-round ELECTRICIANS, with experience in conduit and general electrical installation work, able to read drawings. A knowledge of cable and switchgear erection and overhead work would be useful.

(b) First-class PLUMBER JOINTERS with experience in jointing paper-insulated, lead-covered, and armoured cables up to 11 kV.

Free passage out and return, free quarters, messing, and medical attention. Leave granted and monthly salary. Apply, stating age and experience. Forward copies of testimonials or state names to whom we may apply.—Reply to Box No. 6049, Electrical Times. (K 718)

SALES MANAGER. Young man with light engineering household appliances, car accessories, radio or electrical experience. Appointment full of opportunity.—State age and experience to Box No. 6033, Electrical Times. (K 680)

SENIOR AND JUNIOR DRAUGHTSMEN required for the electrical rotating machinery D/O of a large manufacturing concern in the Midlands. Men with sound mechanical D/O experience and training will be considered. The positions offer scope for advancement to keen men in a rapidly expanding department. Excellent working conditions; sports and social club, etc.—Please apply, giving full details of training, experience, age, etc., to Box No. 6025, Electrical Times. (K 657)

SITE ELECTRICAL ENGINEER. Experienced heavy plant installation work—building, lighting, etc., for supervision of contractors, etc.—Apply, stating age, experience, etc., salary required, to Box No. 5087, Electrical Times. (K 524)

TECHNICAL INSTRUCTORS in the following trades are required by the Kuwait Oil Co. for overseas service in the independent Arab State of Kuwait. (a) Carpentry and joinery, (b) electrical, (c) general engineering fitting, and (d) motor mechanics (Diesel and I.C.). In each case a full apprenticeship is essential and candidates should have had at least three years' experience as a master tradesman. For (a) a City and Guilds Teaching Certificate and for (b), (c) and (d) a National Certificate is desirable. In all cases previous experience as an instructor is essential. Previous experience of the East and a knowledge of Arabic would be an advantage. Starting salary £710 p.a. clear, plus generous living allowances. Age 30-40. Kit allowance. Pension scheme.—Write, giving full details and quoting K.1263, to Box "N.F." c/o J. W. Vickers and Co. Ltd., 7/8 Great Winchester Street, London E.C.2. (K 705)

TECHNICAL LABORATORY ASSISTANTS with some experience preferably in the electronic experimental field are required by the Research Laboratories of The General Electric Co. Ltd., East Lane, North Wembley, Middlesex. Good education essential; beyond Matriculation standard desirable.—Apply, in writing, to the Personnel Officer (ref. GBLC/90) quoting age and record. (K 633)

THE HEAD WRIGHTSON MACHINE CO., LTD., require a fully qualified ELECTRICAL ENGINEER capable of preparing specifications and superintending the installation and starting-up of modern rolling mill and auxiliary machinery. Applications, stating age, experience and salary required, to be addressed to The Director and General Manager, The Head Wrightson Machine Co., Ltd., Commercial Street, Middlesbrough, marked "Private and Confidential." (K 651)

TRAINEE or JUNIOR SHIFT ENGINEERS for duty in Modern Power Station required for Middle East service by large Oil Company. Salary according to age/experience plus substantial allowances. Pensionable posts. Paid Home Leave every two years. Aged preferably under 30, applicants must have had regular training in electrical and mechanical engineering with technical qualification of H.N.C. standard.—Write, giving full details and quoting No. 48, to Box 4205, c/o Charles Barker and Sons, Ltd., 31 Budge Row, London E.C.4. (K 728)

TRANSFORMER TECHNICAL ENGINEER required with particular experience in small h.v. transformers and testing equipment. Must be up to Higher National Certificate standard or equivalent.—Apply, giving details of previous experience, Personnel Officer, Foster Transformers & Switchgear Ltd., South Wimbledon. (K 631)

TWO REPRESENTATIVES required, domiciled Bristol, Leeds or Bradford to sell Fittings, Table Lamps and Shades. Excellent existing connection. Must own car.—Apply "Knightshades," Derby Road, London N.18. (K 704)

WANTED by firm of Electrical Contractors COST CLERK, age over 25. Would consider disabled ex-service man. Salary in accordance with experience.—Apply, Box No. 6045, Electrical Times. (K 716)

WORK WANTED

A.C. and d.c. Motor Rewinds and Repairs. Prompt service, fully guaranteed.—Edgware 3631 (4 lines), Service Electric Co. Ltd., Stanmore, Middx. (D 324)

ARMATURE SERVICE CO. LTD., Haddington Street, Hove (Tel.: 32996), electrical engineers and winding specialists. Distance no object. (F 739)

CAPACITY available for light assembly of electrical mechanical equipment complete from drawings or prototype model, including tooling, moulds, machining and test if required.—Box No. 5077, Electrical Times. (K 485)

CASTINGS, Fisher Foundries Ltd., Great, Birmingham, have capacity for brass, gun metal and soft grey iron machine moulded repetition castings weighing 1-30 lb. Loose pattern work up to 3 cwt. Delivery by road to all parts. Tel.: B.ham, Victoria 0197. (H 268)

WANTED

POULTON-LE-FYLDE URBAN DISTRICT COUNCIL

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May 7, 1951. (K 695)

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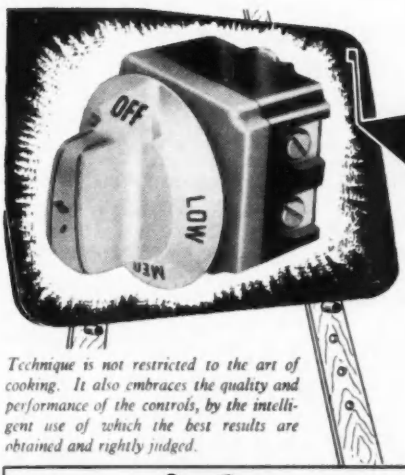

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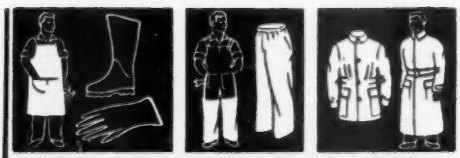

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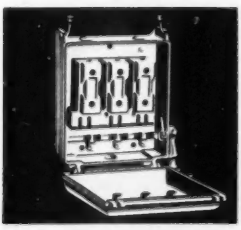

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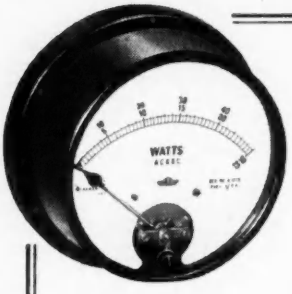

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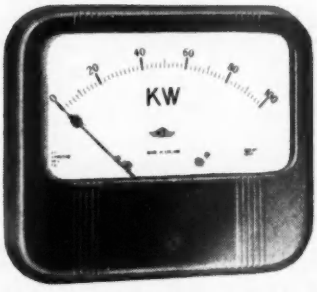

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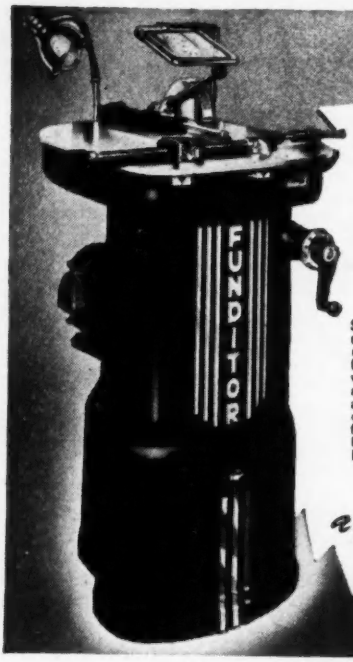

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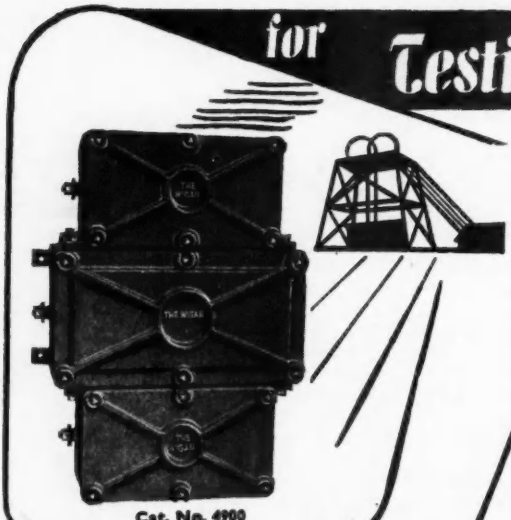

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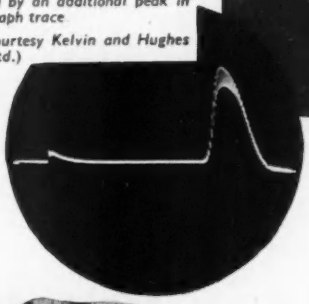
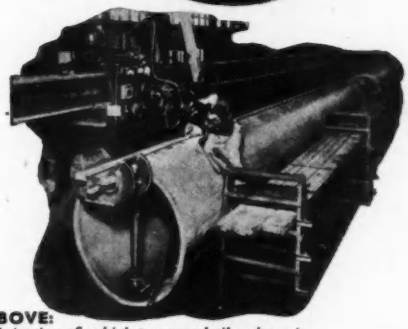
BELOW:
Typical oscillograph trace for a boiler plate submitted to ultrasonic test, indicating freedom from flaws. The existence and location of a flaw would be indicated by an additional peak in the oscillograph trace

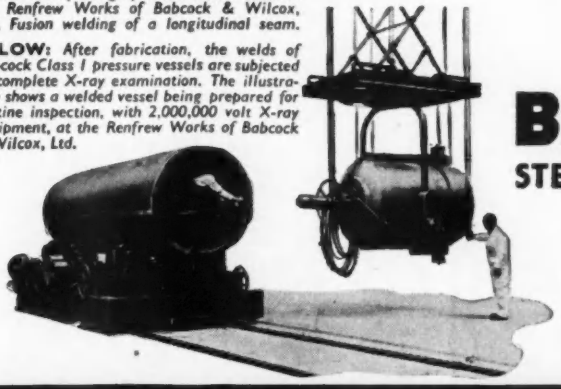
(Photo by courtesy Kelvin and Hughes Industrial, Ltd.)





ABOVE:
Fabrication of a high pressure boiler drum in the Renfrew Works of Babcock & Wilcox, Ltd. Fusion welding of a longitudinal seam.

BELOW: *After fabrication, the welds of Babcock Class I pressure vessels are subjected to complete X-ray examination. The illustration shows a welded vessel being prepared for routine inspection, with 2,000,000 volt X-ray equipment, at the Renfrew Works of Babcock & Wilcox, Ltd.*



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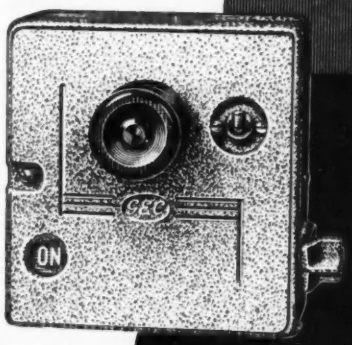

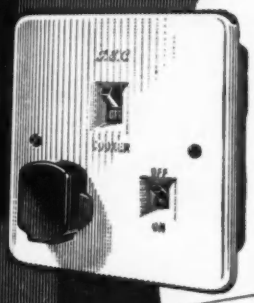

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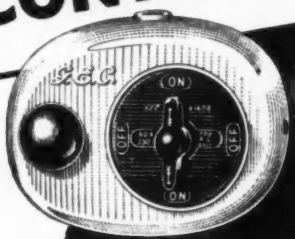

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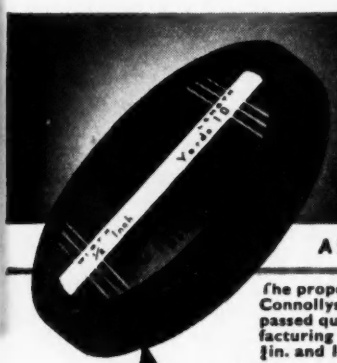

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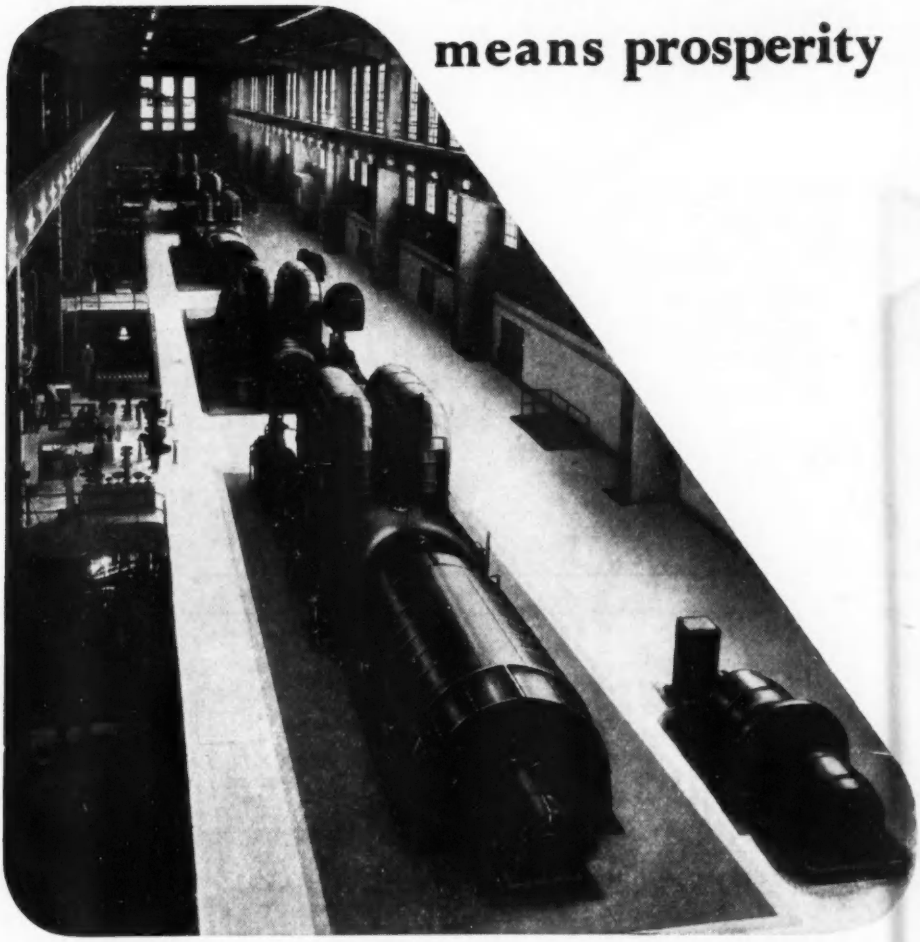

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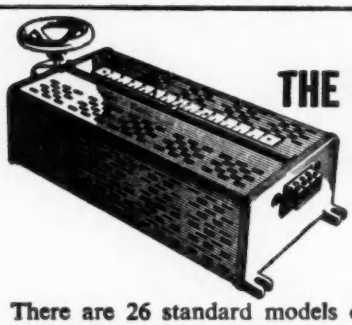

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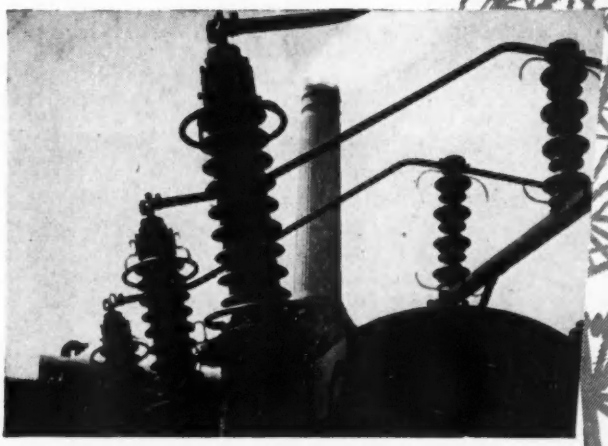

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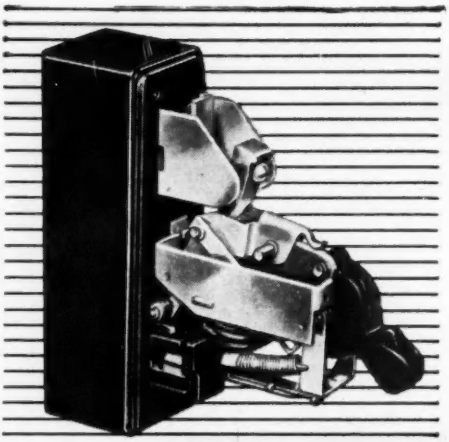

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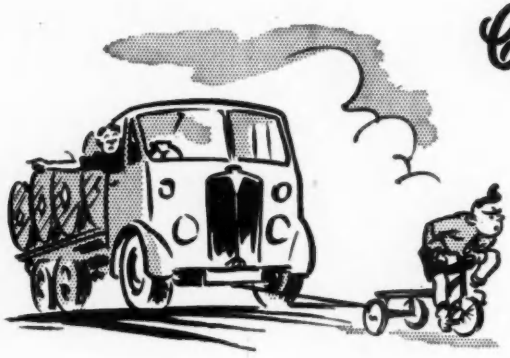

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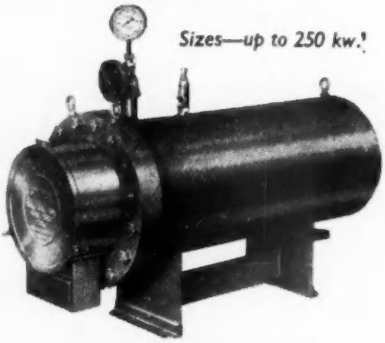

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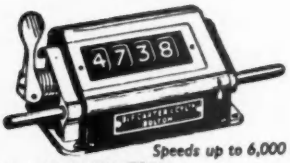

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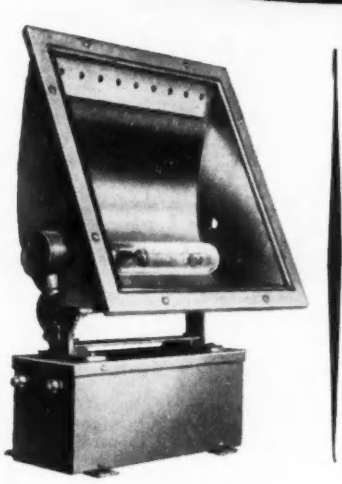

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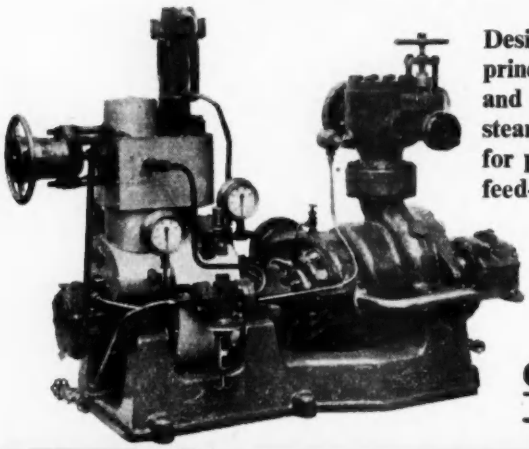

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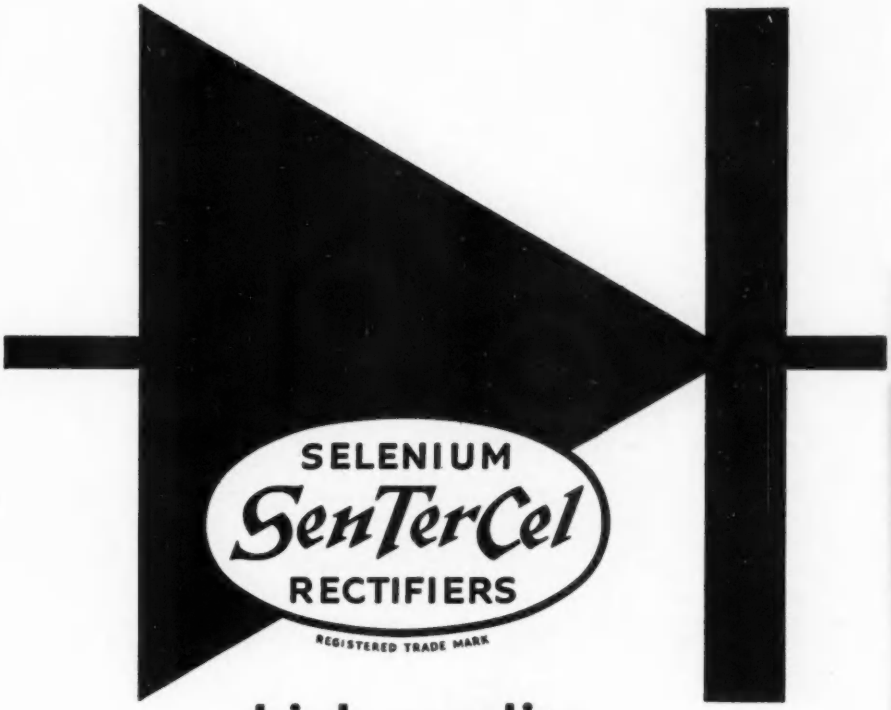

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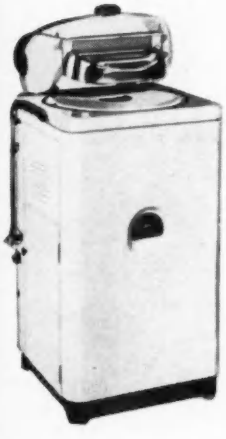

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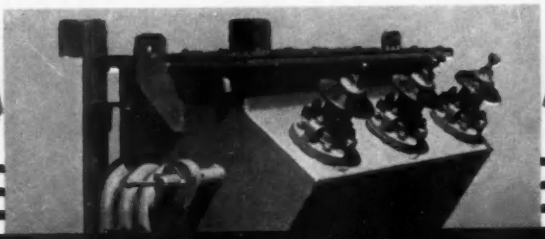

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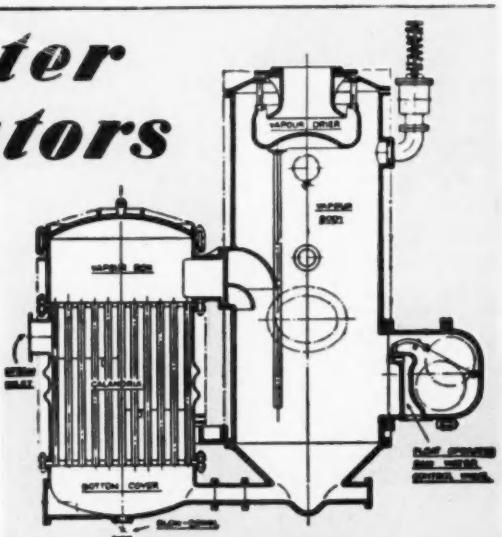

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